PAY FOR PERFORMANCE, POSITION, OR PLACE: THE EFFECT OF INSTITUTIONS ON SALARY EQUITY FOR WOMEN AND MINORITY FACULTY IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS

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THE EFFECT OF INSTITUTIONS ON SALARY EQUITY FOR WOMEN AND MINORITY FACULTY IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS

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LIST OF ABBREVIATIONS

FASB	Financial Accounting Standards Board
FTE	Full-time equivalent
FY	Fiscal year
GASB	Governmental Accounting Standards Board
HBCU	Historically black colleges and universities
HLM	Hierarchical linear modeling
HSI	Hispanic-serving institutions
IPEDS	Integrated Postsecondary Education Data System
NIH	National Institutes of Health
NSF	National Science Foundation
NSOPF	National Study of Postsecondary Faculty
OLS	Ordinary least squares
OPM	Office of Personnel Management
PBI	Predominately black institution
PWI	Predominately white institution
RCM	Resource centered management
SDR	Survey of Doctorate Recipients
SEH	Science, engineering, and health
STEM	Science, technology, engineering, and mathematics
URM	Underrepresented minority

SUMMARY

This dissertation examines organizational influences on gender and racial salary equity among tenured and tenure-track faculty in science, technology, engineering, and mathematics (STEM) disciplines. The study argues that traditional individual and disciplinary explanations for salary inequities fail to capture the institutional variations in conditions among women and underrepresented minority faculty in STEM disciplines. A better understanding of these institutional variations is important for theory and practice as scholars continue to attempt to explain the unexplained salary gaps and policymakers target organizational change to resolve persistent gaps. The results show that individual characteristics and discipline do explain salary gaps among STEM faculty broadly; however, those results vary across organizational settings. Comparisons of gender and racial salary gaps among institutional types show that organizational mission, resources, and power influence the extent of salary parity. The results validate the importance of emphasizing and rethinking institutional categorizations to understand pay disparities among women and underrepresented minority STEM faculty.

CHAPTER 1

INTRODUCTION

1.1 Dissertation Overview

This dissertation examines how gender and racial pay gaps vary across institutional settings—exploring how the identity, resources, and decision-making structure of an institution influence pay equity for women and underrepresented minority science, technology, engineering, and math (STEM) faculty. Within academia, white and Asian male faculty earn more than women and underrepresented minorities in STEM disciplines, on average (National Science Foundation, 2015a). Experience and productivity explain a substantial portion of the salary gaps by gender and race, with unexplained gaps among male and female STEM faculty ranging from zero to 5.5 percent in recent studies (Ceci, Williams, Ginther, & Kahn, 2014; Corley & Sabharwal, 2007; DesRoches, Zinner, Rao, Iezzoni, & Campbell, 2010; Ginther, 2004; National Research Council, 2010; Porter, Toutkoushian, & Moore, 2008). Research on STEM faculty pay, and faculty pay more generally, typically concentrates on those individual-level characteristics as primary explanations for pay gaps, yet policies and programs often aim at institutional change. Further, gender has been the prominent focus of the faculty pay literature, while racial pay conditions have received less attention. This dissertation contributes to the faculty pay literature and science policy literature by incorporating organizational theories into the traditional human capital and disciplinary framework in order to explore how salary disparities differ across organizational settings. Further, the results offer more recent salary data and more detailed analysis of racial groups than prior studies.

1.2 Background on Faculty Pay Disparities

Female academics earn less than comparable male academics—a finding consistent in all but a few pay equity studies from the 1970s to today (Barbezat, 2002; Perna 2003; Toutkoushian 2008). Racial pay gaps are less consistent and understudied due to the small number of minority faculty in academia (Perna, 2003). Higher education administrators sought to rationalize faculty pay beginning in the 1970s, in part due to anti-discrimination requirements in Title VII of the Civil Rights Act of 1964, which were extended to academia in the Equal Employment Opportunity Act of 1972 (Barbezat, 2002). These Acts provided the impetus for the initial faculty salary studies, which set a baseline from which future reward systems could be judged (Barbezat, 2002). Institution-specific pay equity studies gave way to national studies in the 1980s, exploring gender and racial pay gaps primarily through human capital and structural frameworks (Barbezat, 2002). Although scholars have studied gender pay equity broadly across higher education for several decades, their research provides little evidence on pay equity for minorities, recent years, or specific disciplines such as STEM where concerns over career disparities are long-standing.

The National Academies (2010) noted the relevance of pay equity studies for STEM faculty, in particular, given the federal funding and initiatives for women in science and outcomes for female students related to the presence of female faculty. In addition to the broad federal pay guidelines, the Congress has recognized the particular need to encourage equal opportunity in the sciences. The Science and Technology Equal Opportunities Act of 1980 acknowledged the need to promote women and minority STEM careers as part of the national interest (Public Law 96-516). The Act authorized the National Science Foundation (NSF) to construct programs aimed at increasing participation and encouraging opportunity for women and minorities in STEM disciplines. Within the STEM workforce, the condition of women and minorities in academia has been of particular interest given the role of academics in influencing rising scientists and engineers (National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2011; National Science Foundation, 2012).

Women and underrepresented minority faculty have gained ground in STEM disciplines, as in other fields; however, their representation and rewards continue to fall below that of white and Asian male academics on many measures, including median salary (Table 1.1). In 2013, male faculty at four-year institutions earned higher median salaries than female faculty at every rank (full, associate, and assistant) in science, engineering, and health (SEH) disciplines combined (National Science Foundation, 2015a).[1] Asian and white SEH full professors earned more than underrepresented minorities (African Americans, Hispanics, and American Indian/Alaskan) at the median, while Asian associate and assistant professors held the highest median salaries (National Science Foundation, 2015a). Controlling for productivity, education, and discipline, among other factors, the National Research Council (2001; 2010) has offered conflicting accounts of the gender pay gap within STEM disciplines, and little evidence on pay equity by race beyond basic comparisons of means.

[1] The data in Table 1.1 come from the Survey of Doctorate Recipients, which is a longitudinal survey of individuals who hold SEH doctoral degrees from U.S. institutions. This table includes faculty in the health disciplines; however, the remainder of the dissertation does not include health faculty. When possible, the specific fields included in the data will be identified.

Table 1.1 **Representation and Median Salary of Science and Engineering Faculty in Four-Year Academic Institutions by Sex, Race, Ethnicity, and Faculty Rank, 2013**

	Full Professor		**Associate Professor**		**Assistant Professor**	
	Share	Median Salary	Share	Median Salary	Share	Median Salary
Female	21%	$109,000	34%	$80,000	43%	$70,000
Male	79%	122,000	66%	88,000	57%	75,000
White	81%	120,000	75%	84,000	67%	70,000
Asian	12%	120,000	14%	89,000	22%	79,000
Black	2%	106,000	5%	79,000	5%	68,000
Hispanic	3%	106,000	5%	79,000	5%	70,000
Am. Indian/Alaskan	D	94,000	D	79,000	D	D
Other	D	112,000	D	83,000	D	75,000

Source: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Doctorate Recipients, 2013.
Notes: Includes faculty in science, engineering, and health fields. For representation, faculty are in S&E related occupations within four-year academic institutions. D = suppressed to avoid disclosure of confidential information.

1.3 Research Motivation and Research Questions

In both the higher education literature and the science and technology policy literature, human capital and structural theories are prevalent frameworks for studying faculty salaries. Human capital theory provides the rational economic labor market perspective, in which pay follows performance, whereas structural theory offers the sociological labor market perspective, in which pay follows gendered disciplines. Scholars within the higher education literature tacitly acknowledge organizational influences by controlling for institutional type, when possible; however, they have not sufficiently tested organizational theories of institutions and power due to data limitations. The importance of organizational context was well described by Pfeffer and Ross (1990, pg. 58):

> Indeed, we believe that evidence on the existence of sex discrimination in at least some instances is now overwhelming. The challenge which researchers currently face is to move beyond the mere demonstration of occupational or positional segregation and gender-based wage discrimination within jobs, and to begin to

> explore the conditions under which these processes are more or less likely to occur. We need to know, in other words, not only *that* women are paid less than men…, even with numerous factors controlled, but also the organizational contexts in which such gender effects are stronger or weaker…

This dissertation seeks to address that gap in the literature by exploring the institutional contexts within which female and underrepresented minority STEM faculty fare better in pay equity. The institutional focus is important given past research on the benefits of institutionally-focused rather than individually-focused programs for women in science, as well as policy proposals and programs aimed at organizational change (Fox, Sonnert, & Nikiforova, 2009; National Science Foundation, 2009).

The primary focus of this dissertation is the influence of place—organizational setting—on faculty pay equity in STEM disciplines. While controlling for human capital and disciplinary factors, the dissertation will address the following research questions:

1. Institutional identity: Do certain institutions have an identity or mission that leads them to exhibit greater pay equity compared to other institutions?
2. Organizational resources: Does the size and composition of resources influence pay disparities by gender and race/ethnicity?
3. Organizational power: Does the decentralization of budgetary decision-making influence gender and racial pay disparities?

1.4 Theoretical and Practical Implications

Few studies have compared faculty salary gaps across institutional types, and those that have were restricted to research, doctoral, comprehensive, and liberal arts classifications. The data employed here expand institutional types to include women's colleges and historically black colleges and universities (HBCUs), which this dissertation will examine as institutions serving underrepresented groups. Variation in their reward structures compared to other institutions could further our understanding of whether institutional identity influences pay equity within an organization. The dissertation also moves resource dependency theory from the departmental to the institutional level—exploring whether slack resources and decentralized decision-making structures open the door for discrimination.

Additionally, the dissertation relies on more recent data than prior studies, which offers an opportunity to observe whether pay gaps are changing. Although findings are fairly consistent in observing an unexplained gender pay gap among STEM faculty, that gap has been shrinking (National Academy of Sciences - National Research Council, 2001). Thus, it is important to study these questions of faculty pay equity with new data to determine whether progress towards pay parity continued. Finally, the dissertation provides a more detailed view of STEM faculty issues, especially under-represented minorities, whose outcomes are often neglected in the higher education literature on pay equity.

1.5 Organization of the Dissertation

This chapter offered an introduction to the issue of salary equity among STEM faculty, along with the research questions and implications of the dissertation. Chapter 2 reviews the theoretical underpinnings and empirical findings on salary equity, with attention to academic faculty broadly and STEM faculty in particular when possible. The chapter lays out common explanations for gender and racial gaps in salary at the individual and disciplinary level then offers hypotheses at the institutional level. Chapter 3 describes the primary data source—the NETWISE II Survey, a large-scale survey of tenured and tenure-track STEM faculty—as well as secondary data sources, variable operationalization, descriptive statistics and methodology. Chapter 4 reports results from OLS regression analysis on traditional explanations for salary gaps and the hypothesized institutional influences. Chapter 5 offers discussion on the theoretical and policy implications of these results and concluding remarks.

CHAPTER 2: CONCEPTUAL FRAMEWORK

2.1 Introduction

Organizational setting contributes to career disparities among STEM faculty through such factors as varied access to resources, workplace climates, and tenure and evaluation policies (reviewed in Fox, 2008). With these dissimilarities in setting come pay differentials across different groups of academics (Curtis & Thornton, 2014), yet the primary explanations for gender and racial pay disparities are individual and disciplinary factors rather than organizational. Economists have explained pay gaps in the general labor market through employees' human capital differences (Becker, 1993), employers' taste for discrimination (Becker, 1957), and employers' statistical discrimination (Aigner & Cain, 1977). More recently, Goldin (2014) theorizes pay gaps among "winner-take-all" professions, including academia, as a tension between women's greater desire for flexibility and the prominence of number of hours worked in reward structures. In contrast, sociologists point to stratification of groups (such as by gender) into different occupations or disciplines, which then become valued according to the dominant group (Baron & Hannan, 1994; Bellas, 1994; Fox, 1981, 2008; Reskin & Bielby, 2005).

This dissertation argues that, in addition to the individual and disciplinary determinants of salary found in traditional models, organizational setting influences pay equity among women and underrepresented minority STEM faculty in a number of ways. As Stainback and colleagues argue in stratification research:

> An organizational perspective on inequality suggests that a theoretical account should be built at the intersection of (*a*) organizational structure, logic, and practice; (*b*) the relative power of actors within workplaces; and (*c*) organizations'

institutional and competitive environments. (Stainback, Tomaskovic-Devey, & Skaggs, 2010, p. 242).

This dissertation seeks to understand that intersection by applying organizational theories of institutions, resources, and power to explain pay inequity among women and underrepresented minority STEM faculty across institutions.

This chapter reviews theoretical foundations and empirical findings on pay disparities and offers hypotheses on such disparities among STEM faculty. In addition to this introduction, the chapter has three sections. Section 2.2 presents the common individual and disciplinary explanations for salary gaps among academics, and STEM faculty in particular where possible, in order to establish the foundation for the model presented later in the chapter. Section 2.2 reviews the "explained" portion of the salary gap—variation in achievements or human capital attributes—and then provides the most recent data on the unexplained portion of salary gaps among women and underrepresented minorities. The discussion situates STEM faculty pay within the higher education literature on pay equity among all academics given the more robust evidence in the higher education literature; however, the broader findings across academia may not always reflect the experiences in STEM given the greater gender imbalance and higher salaries found in most STEM disciplines. Then Section 2.2 attends to sources of salary variation often noted in the literature including marriage and family, negotiation ability, social capital, and discipline. Each of these salary predictors will be modeled in the dissertation; however, the hypotheses focus on institutional-level explanations of pay disparities among women and underrepresented minority STEM faculty.

Section 2.3 provides the theoretical basis for organizational influence on faculty pay and offers hypotheses on institutional-level determinants of pay disparities among STEM faculty. The dissertation hypothesizes that an institutional mission of diversity and access will lead to smaller pay disparities among STEM faculty, whereas competition among institutions will result in larger pay gaps. With regards to power, decentralization of salary-setting into the hands of autonomous department chairs will open the way for greater pay disparity among women and underrepresented minority faculty. Finally, Section 2.4 offers a summary model that incorporates these institutional determinants into the traditional pay equity models for three levels of salary determinants: 1) individual level factors (personal characteristics, human capital, and career advancement), 2) structural factors (gender composition of discipline), and 3) institutional level factors (mission, resources, and power).

2.2 Foundations of Faculty Pay Disparities

2.2.1 Human Capital Theory and Findings: Explained Salary Gaps

Human capital refers to the skills and knowledge individuals possess due to education and training (Becker, 2008). According to human capital theory, earnings depend, in part, on education, training, and experience as these lead to increased productivity (Becker, 1993). Workers invest in education and training in a rational manner, according to the theory, with an eye towards the rates of return to such investments. For example, older workers are less likely to engage in additional schooling compared with younger workers because the years of benefits from such additional schooling will be less for older workers. Likewise, the theory says, women will make lower human capital investments because of their more tenuous attachment to the labor market and will be rewarded less than men accordingly. Thus, human capital theory arises from neoclassical economic theory in which the individual rationally attempts to maximize utility (Tan, 2014). Becker, Schultz, and Mincer in the 1960s and 1970s defined and explored the theory, examining the influence of years of education (formal training) and years of experience (informal training) on individual earnings as well as national economic growth (Sweetland, 1996).

As expected in human capital theory, education, experience, and productivity influence faculty earnings in academia overall and in STEM disciplines. With increases in level of degree earned and years of experience, salaries rise among comparable faculty (Barbezat & Hughes, 2005; National Research Council, 2010; Perna, 2005; Toutkoushian, Bellas, & Moore, 2007; Tuckman, 1976; Umbach, 2007). Seniority or job tenure within one's current institution also has positive effects on salary, albeit at a diminishing rate; however, this finding is less consistent in the literature than years of experience overall (Barbezat, 2004). Productivity as measured by higher levels of publications and administrative responsibilities increases salary, while the links between teaching and pay are consistently weaker if they exist at all (Barbezat & Hughes, 2001, 2005; National Research Council, 2010; Perna, 2005; Toutkoushian, et al., 2007; Tuckman, 1976; Umbach, 2007). Ability to attract grant funding, which can be viewed as a productivity measure, enhances salary as well (National Research Council, 2010; Umbach, 2007). Although human capital theory posits mobility as a benefit to earnings, Barbezat and Hughes (2001) found mobility in terms of number of positions to matter very little for faculty salaries in academia overall.

Human capital attributes are generally agreed to be legitimate or acceptable factors for determining faculty pay (Ferber & Loeb, 2002; Fox, 1981). In scientific fields, productivity, accompanied by originality and creativity, has long been exalted as defining worth (Cole & Cole, 1967; Merton, 1957), although more recent research has shown that determinations of productivity and merit themselves can be vague or biased (Fox, 2015). If faculty systematically vary in their human capital by gender and/or race, then their pay will vary systematically as well. This variation in salary among male and female faculty and by race due to human capital attributes is often termed the explained variation in salaries.

Variations in human capital do explain a portion of the salary gaps between male and female faculty, as well as by race/ethnicity, in academia broadly. From the 1993 National Study of Postsecondary Faculty, male faculty were more likely to be full professors or tenured, have more years of experience, and spend less time teaching and more time in administration (Nettles, Perna, & Bradburn, 2000). Each of those characteristics is positively related to salary. Asian and white faculty were more likely to be tenured or full professors, as well as more experienced (Nettles, et al., 2000). African-American faculty devoted less time to research and were less likely to hold PhDs than white and Asian faculty. Hispanic faculty were more likely to work in two-year institutions, to be younger, and to have been in their current position for less time than white faculty.

In STEM, white and Asian male faculty have a salary advantage, on average (National Science Foundation, 2015a); however, human capital variables explain a substantial portion of that advantage, similar to faculty in other disciplines. Women faculty in STEM are younger, less likely to hold top ranks, and more likely to spend longer times in lower ranks (National Research Council, 2010). Women in STEM have traditionally trailed men in journal publications, though not in citation counts per article (reviewed in Ceci, et al., 2014). However, more recent data show no significant difference in productivity (Feeney & Welch, 2015). Grant-getting ability favors men in some instances, with women applying less frequently and men receiving larger grants (reviewed in Ceci, et al., 2014).

Among underrepresented minorities, black faculty in STEM have proportionally more teaching positions, have smaller numbers of publications and patents, and are more often in historically black colleges and universities (HBCUs) (National Science Foundation, 2015a, 2015b). Black and Hispanic STEM faculty hold administrative positions in smaller proportions than whites, receive federal support in smaller proportions than both white and Asian faculty in S&E occupations, and achieve full professor rank in smaller proportions than white faculty (National Science Foundation, 2015a). These lower levels of experience and productivity among women and underrepresented minorities explain a portion of the salary gap in STEM disciplines; however, as discussed below, some studies find gaps even after controlling for these human capital attributes.

2.2.2 Limits of Human Capital Theory: Unexplained Salary Gaps

Although human capital and productivity factors explain a portion of the variation in faculty salaries, the theory is not without criticism, especially as it relates to gender equity. In the economic models of human capital theory, discrimination should not exist in the long-term since women would be substituted for men if their pay was lower (Toutkoushian, 2003). Pay would eventually equalize. However, such market forces have not eliminated the earnings gap between male and female faculty, with few exceptions in the literature (Perna, 2003). As Toutkoushian (2003, p. 312) notes:

> The theories of labor economics have not adequately accounted for the fact that seemingly comparable men and women often receive different wages in academia. Is this due to the limitations of the model, or insufficient data on human capital attributes, or both?

Perna (2003) notes that even if human capital factors explain salaries, such investments themselves may be discriminatory. For example, organizations may invest less in women's training rather than women choosing to make lower investments. Academic rank and administrative experience—both human capital variables of experience—have been controversial as a legitimate explanatory variable, given that promotion policies and practices themselves may favor men (Ferber & Loeb, 2002). Further, these models rest on economic assumptions of perfect knowledge on the costs and benefits of additional education and training, carrying the limitations of those assumptions into the models (Tan, 2014). Finally, although human capital attributes are considered legitimate factors, measuring those attributes can be subjective (Benschop & Brouns, 2003; Bridges & Nelson, 1989; Fox, 2015).

For scientists, in particular, the human capital model of education, years of experience, and publication productivity fails to account for key individual and social aspects of scientific knowledge production (Bozeman, Dietz, & Gaughan, 2001). Bozeman and colleagues (2001) offer the scientific and technical human capital (S&T human capital) model as an expanded version of the traditional human capital model to better capture the experience of scientists. S&T human capital incorporates productivity beyond publications (e.g., grants) and moves analysis to the group and network levels in recognition of the social, collaborative nature of scientific work. Thus, while traditional human capital and productivity are rewarded in faculty pay systems, including for STEM faculty, the traditional models do not fully explain the capabilities of faculty or the variation in their salaries.

With few exceptions, scholars have found that male faculty have an unexplained salary advantage over comparable female faculty in academia overall (Barbezat, 2002; Nettles, et al., 2000; Perna, 2003; Toutkoushian, et al., 2007). Although the total average salary gap has remained around 20 percent, the unexplained or discriminatory gap has decreased from around 6 to 8 percentage points in the 1990s to 4 to 5 percentage points in more recent studies (Barbezat, 2002; Barbezat & Hughes, 2005). Controlling for human capital and disciplinary differences, Umbach (2007) observed a 6.8 percent or $5,400 unexplained gender gap among faculty in Research I and II institutions. In one of the most recent single equation models, Toutkoushian and colleagues (2007) found a 3.9 percent unexplained salary advantage for male faculty, controlling for race, marital status, human capital factors, and discipline. Again, these findings are for postsecondary education overall, and it is unclear whether the same level of disparities would be present in STEM disciplines given the greater gender imbalance. Additionally, the findings are dated due to the federal government ending the National Study of Postsecondary Faculty in 2004.

While gender pay disparities are well-established in the higher education literature, our knowledge of racial pay disparities in academia is limited since the low minority representation makes statistical analysis difficult. In the few early institution-specific studies relying on 1960s and 1970s data, African-American faculty were consistently found to have an average salary advantage, on the order of 7 to 13 percent (reviewed in Barbezat, 2002). The salary advantage was attributed to the small population of minority faculty, coupled with high demand due to the implementation of federal and institutional-level anti-discrimination policies (Barbezat, 2002). Barbezat and Ashraf separately examined the changing racial pay gaps using national surveys across three decades and provide comparable results (reviewed in Barbezat, 2002). Their findings show a white salary advantage in the 1960s shifting to an insignificant difference or minority salary advantage in the 1970s and 1980s.

These early studies relied on either African-American as the minority subgroup or “nonwhite” as an aggregate group, whereas more recent studies disaggregate race/ethnicity to offer mixed results. Using the 1993 National Study of Postsecondary Faculty (NSOPF:93), Nettles and colleagues (2000) disaggregated minorities and found no significant difference in salaries among white, black, Hispanic, and Asian faculty when controlling for other factors. However, Toutkoushian (1998) found mixed results using the same data by further disaggregating by gender. Compared to similar white female faculty, African-American women enjoyed an unexplained salary advantage. Hispanic and “other race” men experienced a salary disadvantage compared to white men. All other groups (black men, Hispanic women, Asian men and women, and other race women) did not have significantly different salaries than white faculty of the same gender. Using the NSOPF:99, Toutkoushian and colleagues (2007) found a 4.3 percent unexplained salary advantage for Asian faculty over white faculty and insignificant differences for African-American and Hispanic faculty compared to whites. Porter and colleagues (2008) found a salary advantage for African American and Latino *junior* faculty in comprehensive institutions, yet not in other institutions; whereas white faculty combined (junior and senior) had an advantage in liberal arts colleges. Thus, among the few studies of racial pay gaps in postsecondary education overall, the findings vary considerably depending on the controls and aggregations.

When controlling for human capital and productivity, the unexplained salary gap among men and women in *STEM disciplines* ranges from nonexistent to 5.5 percent in studies using data from 2001 to 2008 (Ceci, et al., 2014; Corley & Sabharwal, 2007; DesRoches, et al., 2010; Ginther, 2004; National Research Council, 2010; Porter, et al., 2008). From the 1970s through the 1990s, male faculty held a persistent, but shrinking unexplained salary advantage over comparable STEM female faculty (National Academy of Sciences - National Research Council, 2001). Since the 1990s, the evidence is mixed and difficult to compare given the range of years, control variables, fields, and populations (Table 2.1). In a 2004 survey in Research I universities, the National Research Council (2010) found that men earn more than comparable women at the full professor rank in simple models controlling for academic age and discipline. However, when factors such as productivity, institutional prestige and type, and grant funding are included, the salary advantage loses its significance. Even in the simple models, assistant and associate professors demonstrate salary parity (National Research Council, 2010). Porter and colleagues (2008) observe an unexplained gender gap of 5.5 percent among STEM faculty—somewhat higher than the gap among arts, humanities, and social science faculty. However, among *junior* STEM faculty (those within the first three years of hire), the authors did not find a gender pay gap (Porter, et al., 2008). Focusing solely on life sciences faculty, DesRoches and colleagues (2010) found an unexplained gender gap of more than $13,000 after controlling for productivity and other professional characteristics. Ginther (2004) finds an unexplained male salary advantage among STEM faculty, but more so at the full professor level. The ability of “observable characteristics” and productivity to explain some of the gap is sizeable, lowering the total pay gap from roughly 12 percent to an unexplained gender gap of 3.5 percent for full professors.

Table 2.1 **Summary of Gender Salary Gaps in STEM**

Article	**Data years**	**Fields**	**Specific population**	**Unexplained male advantage**	**Data source**	**Controls**
Ginther (2004)	1986-2001	STEM	Assistant and associate	Less than 1%	SDR	"Observable characteristics" (Does not include productivity)
	2001	STEM	All	2.0%	SDR	Same as above
	2001	STEM	Full	3.5%	SDR	"Observable characteristics" and productivity
Corley and Sabharwal (2007)	2001	STEM	All full-time academics (includes adjunct)	$2,833	SDR	Citizenship status, institutional type, productivity, discipline, experience, rank, primary work activity
Porter et al (2008)	2004	Natural sciences and engineer-ing	All	5.5%	NSOPF	Citizenship status, race, education, experience, rank, productivity, institutional type
			Recently Hired	Insignificant	NSOPF	Same as above
National Research Council of the National Academies. (2010)	2005	Biology, engineer-ing, math, chemistry, physics	Assistant and associate, R1	Insignificant	Survey	Discipline, age
			Full, R1	8%	Survey	Same as above
			All, R1	Insignificant	Survey	Discipline, age, institutional prestige, grant funding, institutional type (public/private), rank, productivity
DesRoches et al (2010)	2007	Life sciences	All	$13,228	Survey	Productivity, rank, professional activities, race
Kahn (2013) (reviewed in Ceci et al 2014)	2008	Engineeri ng	Tenure-track	2%	SDR	Unknown
Kahn and Ginther (2012)	1995-2013	Biomedic ine	Tenure-track or tenured	10.1%	SDR	PhD year, race, foreign born status, age at PhD, years since PhD, institutional ranking, funding in grad school

Although it is difficult to synthesize these findings given the varying populations and controls, the pattern of a greater gender salary gap at the full professor level seems clear. Porter and colleagues (2008) suggest that the finding may point to success in equity efforts in STEM, at least for new hires. Ginther (2004), however, notes the importance of years of experience in driving male/female salary differentials, which may help to explain the larger gap among full professors. Male full professors have more experience, which explains the largest portion of the salary gap between genders (Ginther 2004). Additionally, men receive higher rewards for each additional year of experience compared to women—meaning, variable rewards for experience helps drive men and women's salaries further apart. Productivity, on the other hand, explained little of the salary gap among full professors. Ginther's (2004) results echo earlier findings on "reward dualism," wherein male and female academic scientists are both rewarded for achievements but at different rates (Fox, 1981).

Similar studies of racial pay gaps for STEM faculty are scarce and typically fail to provide significant results given the small share of minority faculty. Basic data from the National Science Foundation (2015c) shows similar median salaries among racial groups for recent cohorts taking gender and academic age into account. The salary gap between Asian men and women in older cohorts is the most striking divergence. Scholarly research on minority STEM faculty often relate to issues of representation rather than salary equity and tend to offer qualitative accounts of experiences (Ginther & Kahn, 2012). In reviewing 252 publications from 1988 to 2007 on faculty of color in all disciplines, Turner and colleagues (Turner, Gonzalez, & Wood, 2008) identify five related to salary equity, none of which directly speak to salaries among minority STEM faculty. Since that time, three studies examined racial pay gaps among faculty in various STEM fields using data from 1995 to 2004 and found insignificant results (DesRoches, et al., 2010; Palepu, Carr, Friedman, Ash, & Moskowitz, 2000; Porter, et al., 2008). Foreign-born STEM faculty (including tenured, tenure-track, and adjunct) earned $1,188 less than U.S.-born faculty on average, controlling for gender, experience, institutional type, primary work activity, discipline, rank, and productivity based on the 2001 SDR (Corley & Sabharwal, 2007).

In summary, human capital and productivity factors explain a portion of the salary gap among STEM faculty, similar to other faculty, but fail to account for the entire gap at least among male and female full professors. The following discussion reviews explanations for the salary gap not attributable to human capital, looking at additional individual characteristics, as well as disciplinary differences in pay.

2.2.3 Alternative Individual Explanations to Human Capital

Beyond human capital and productivity, individual characteristics purported to contribute to career disparities among faculty are marital status, family status, negotiating ability and social capital. These influences typically offer a gendered perspective, but can relate to race as well. If spouses and children place greater mobility and time constraints on women, then outcomes could vary by gender. If men negotiate better than women, then salary advantages can be cemented from the first job. If genders or racial groups have varied social capital through networks, then outcomes may vary as well. These concerns are prevalent in studies on gender representation in STEM given the potential link to preferences on entering and exiting the pipeline (Ceci, et al., 2014); however, such individual characteristics are less studied as they relate to salary among STEM faculty.

The following discussion reviews evidence on marriage, parenthood, negotiation and social capital on pay from the STEM literature.

2.2.3.1 Marriage and Children

Marriage and children are thought to influence salary in complex ways, through both premiums and penalties across genders (Kelly & Grant, 2012). Explanations of the role of marriage among academics in general, include: 1) men receive "family wages," 2) women become geographically constrained, 3) colleges expect women's income to be secondary, and 4) men receive support from marriage that increases productivity (Toutkoushian, et al., 2007). For women, having children may result in reduced work hours, further restricted mobility, or gaps in employment—all of which may contribute to lower salaries (National Research Council, 2010). Given these explanations, we would expect to see salary disadvantages for married females with children, in particular, along with salary advantages for married men.

Although marriage and family are often cited as barriers to women in science (National Research Council, 2010; Williams & Ceci, 2012), the direct link to salaries appears tenuous. Broadly in higher education, marriage/cohabitation brings a salary advantage (Toutkoushian, et al., 2007). Toutkoushian and colleagues (2007) found a similar advantage for women and men in academia overall, which contradicts earlier findings of negative consequences for married women. Within STEM in the 1990s, Ginther (2003) found a marriage premium for men, as well as positive effects on salary from parenthood for both men and women. Ginther (2003) finds a 1.7 percent gap among full professors due to parenthood. She concludes: "Overall, I cannot attribute the gender salary gap to women's preferences for children" (Ginther, 2003, p. 24). More recently, Kelly and Grant (2012) find similar salaries for married mothers, single childless men, and single fathers compared to married fathers in STEM fields, due in part to controls for productivity. The greatest disparity identified was single childless women, who earn 9.2 percent less than married fathers in STEM controlling for academic age, administrative duties, institutional type, and productivity (Kelly & Grant, 2012). These findings contradict women's overall labor market experience wherein men and childless women out-earn comparable women with children (Goldin, 2014).

An issue with these cross-sectional studies is that they capture the women who have persisted, and thus bias results towards women who did not leave academia due to family considerations (Feeney & Welch, 2015; Fox, 2005). Fox (2005, p. 142) notes the possibility that female STEM faculty in doctoral-granting universities who have young children may have "strong stamina for and commitment to research" and comprise a "super-select" group of academics wherein the presence of children increases productivity. Interestingly, female STEM faculty with preschool-aged children demonstrated the highest productivity, suggesting nuance in the relationship between productivity and family status beyond just the presence of children (Fox, 2005). Although marriage and parenthood appear to be working in the opposite (i.e., positive) direction than expected for female STEM faculty salaries, those statuses may yet contribute to the overall salary gap between genders. In a 1994 survey of full-time STEM faculty, Fox (2005) found that men were more likely to be married (86% compared to 62% of women) and to be a parent (79% compared to 48% of women). Thus, if marriage and parenthood bring greater rewards, perhaps through the increased productivity that Fox finds associated with those statuses, then men are more likely to reap those rewards given their greater concentrations in marriage and parenthood.

2.2.3.2 Negotiation Ability

Academic salaries are negotiated agreements. If negotiation ability varies by gender or race, then such abilities may be contributing to the unexplained salary gap among academics. The concern around negotiation stems from the importance of starting salaries in the academic system, which often relies on incremental growth thereafter. One group of scholars provide the adage for academic salaries: "The intercept is negotiable, but the slope is fixed" (Warman, Woolley, & Worswick, 2010, p. 368). The common perception is that men are better negotiators than women. Personality traits, such as niceness versus antagonism, are said to be at play in negotiation with gender divides across traits (Bowles, Babcock, & Lai, 2007; Mueller & Plug, 2006). In recent popular culture, the "Lean In" phenomenon has advanced the notion that women have failed to be as aggressive or bold in career pursuits, including salary negotiations (Sandberg & Scovell, 2013). The American Association of University Women (2015) offers seminars in negotiating tactics for females, citing their belief that improving such skills will reduce the gender gap. Babcock and colleagues (2003) review several of their own studies as well as others employing varied groups outside of academia, which consistently show men negotiate more frequently and enjoy more benefits from negotiations than women do. Women ask less often, make smaller asks, and concede more quickly (Babcock & Laschever, 2003). Additionally, women may experience negative consequences or backlash from negotiating (Bowles, et al., 2007).

Although there is evidence of a male negotiating advantage broadly, other research has shown inconsistent results, leading negotiation scholars to argue for deeper contextual accounts (Small, Babcock, Gelfand, & Gettman, 2007). Information availability can influence the gender gap in negotiation, thus there may be industry differences given varying levels of salary transparency (Babcock & Laschever, 2003). For higher education, at least public institutions, salary information should be more readily available than in other industries. Thus, we might expect that male and female negotiation levels are more on par in academia.

Female academics report similar rates of negotiation—and somewhat higher in at least one study—as their male colleagues across the few studies on the issue (Crothers et al., 2010; De Riemer, Quarles, & Temple, 1982; Feeney & Welch, 2015; Mitchell & Hesli, 2013). De Riemer and colleagues (1982) found female assistant professors attempt initial salary negotiations at a slightly lower rate than male faculty; however, they demonstrate similar rates for pursuing salary increases thereafter. Success rates among men and women faculty were similar for initial negotiations and somewhat higher for women in later salary increases. More recently, female STEM faculty in research intensive/extensive universities reported higher levels of negotiation on their first job offers, as well as higher rates of success in such negotiations (Feeney & Welch, 2015). Also in academia, outside offers can play an important role in salary renegotiations as faculty leverage offers to negotiate with their current institutions (Ceci, et al., 2014). The pursuit of outside offers may contribute to gender pay gaps in academia; however, the evidence is mixed. Blackaby and colleagues (2005) report that female economists in the UK pursue outside offers less frequently and generate lower pay-off from such offers. In contrast, the National Research Council (2010) finds similar levels of self-reported outside offers among men and women in STEM disciplines. In summary, although negotiating ability is commonly thought to affect the gender pay gap, the evidence is less compelling in academia than in the labor market as a whole.

2.2.3.3 Social Capital

Human capital's inability to explain fully the salary gaps among faculty opens the way for other forms of capital to aid in explanation. Like human capital's returns from investment in education, social capital relates to "investment in social relations with expected returns" (N. Lin, 1999, p. 30).[2] Social capital in the form of networks influences career outcomes such as job mobility, promotion, satisfaction, and earnings through access to resources and information (Borgatti & Foster, 2003; Boxman, De Graaf, & Flap, 1991; Granovetter, 1983; Seidel, Polzer, & Stewart, 2000). Thus, when networks vary by gender and/or race, they can contribute to cumulative advantage by presenting additional opportunities to certain groups (Belle, Smith-Doerr, & O'Brien, 2014).

As mentioned in the discussion on human capital (Section 2.2.2), scholars recognize social capital as a fundamental component of scientific work and knowledge production (Bozeman, et al., 2001). Bozeman and Mangematin (2004, p. 565) highlight the importance of social capital and collaboration in the science and engineering fields, saying social networks and human capital are the "two pillars supporting scientists' and engineers' ability to contribute knowledge." Networks are present in STEM faculty's conferences, journals, grant awards, and career trajectories (Bozeman & Mangematin,

[2] The discussion here relies on the individual as an analytic approach, following on Lin (1999) and others; however, networks are studied from a variety of levels including organizational (see (Whittington & Smith-Doerr, 2008)) for example of hierarchical versus networked structures and implications for women scientists' productivity).

2004) and show some variation by race and gender (Belle, et al., 2014; Feeney & Welch, 2009; Pinheiro & Melkers, 2011).

STEM faculty with larger close collaboration networks and those with greater numbers of external collaborators in the network have higher levels of journal article publication (Feeney & Welch, 2009). Underrepresented minority STEM faculty have more external collaborators and produce fewer publications per internal tie than white male faculty, suggesting a need to find support outside their home institution (Pinheiro & Melkers, 2011). For STEM faculty in research intensive/extensive universities, women have larger networks that have more external ties, senior collaborators, and women (Feeney & Welch, 2015). Network structures did not significantly influence salary differences between men and women in a cross-section of their outcomes in one study; however, the network structures did influence salary change over time (Feeney & Welch, 2015). Men's social capital—such as network size and number of senior collaborators—translates into higher rewards over time, while women do not experience the same salary increase over time from higher levels of social capital (Feeney & Welch, 2015). This preliminary work connecting STEM faculty networks to salary suggests that social ties may be an overlooked aspect explaining faculty salaries.

2.2.4 The Discipline: Structural Theory and Findings

Moving from the individual-level to the occupation-level, academic fields vary substantially in salaries, with STEM faculty being some of the top earners. In 2009-2010, for example, engineers at large public institutions earned an average salary 25 percent higher than the average salary of English professors at the full professor rank and 42 percent higher at the assistant rank (American Association of University Professors, 2011). Disciplinary differences in pay contribute to the total salary gap between male and female faculty in academic overall given the concentration of women in lower-paying disciplines.

Sociologists argue non-market forces exist that segment the labor market into more and less highly valued positions and tasks, with rewards following the value system and creating inequities (Perna, 2003). In higher education, segmentation occurs through the categorization of full-time and part-time faculty, as well as by discipline (Perna, 2003). These segmentations can create inequities as movement between full-time and part-time positions or across fields is limited. Stratification or structural theory suggests, and empirical findings support, that such segmentation of the labor market creates gendered roles, with women filling lower status positions and disciplines (Bellas, 1997). This sex segregation of jobs has greater influence on certain career outcomes than an individual's sex (Reskin & Bielby, 2005).

Studies of disciplinary differences in academic salaries show an average pay advantage for both male and female faculty in low-female disciplines (Bellas, 1994, 1997; Umbach, 2007). Average salaries by discipline were 0.3 percent lower with each percentage point increase in female faculty among Research I and II institutions in 2004 (Umbach, 2007). Similarly, the gender composition of institutions and institutional units (teaching, administrative, and service units) can influence gender pay disparities (Fox, 1985; Umbach, 2008). Although racial compositions have not been examined in academia, at least one study of state government employees attributed 21 percent of the racial pay gap to the racial composition of the job (Tomaskovic-Devey, 1993).

Whereas gender, race, marital status, and certain other individual characteristics are not seen as legitimate salary determinants, discipline has been viewed as a legitimate factor in salary differences by some researchers. Ferber and Loeb (2002) include discipline along with human capital and productivity factors as valid variables to include in an institutional salary equity study. The authors note that disciplines have different external labor market pressures that must be taken into account in such institution-specific studies. However, such labor market forces do not fully account for the gender inequities across disciplines and can themselves draw in structural imbalances occurring outside academia (Bellas, 1994; Marschke, 2004). Acknowledging this, Ferber and Loeb (2002, p. 45) conclude: “Thus, while believing that academic discipline must be controlled in any salary-equity study, we also suggest that an institution that differentiates salaries according to discipline might examine in a separate study whether the degree of differentiation it practices is entirely justifiable.” Going further, advocates of comparable worth strategies argue for raising wages in female-dominated jobs through job evaluations that diminish bias arising from market forces (Bellas, 1994; England, 1999).

Although studies focused on gender composition in academia offer insight into structural barriers, they do not fully address the labor market segmentation that occurs. They do not account for institutional variation that can offer another level of segmentation. Further, the existing literature does not provide comparison across STEM disciplines. There is a spectrum of representation within STEM. Women comprise 23.4 percent of full professors in life sciences and only 7.5 percent in engineering (Table 9-23, Survey of Doctorate Recipients, 2013). Thus, the effect of gender composition on salary across STEM disciplines remains an outstanding question.

2.3 Explaining the Unexplained: Organizational Influences on Pay

Institutional types offer another segmentation of the academic labor market that, similar to discipline, can be difficult to traverse and can contribute to pay gaps among faculty in concert with the individual-level human capital variations.[3] Scholars include institutional variables to control for effects on salaries, finding salary advantages for faculty in research-oriented, private, unionized, and more prestigious institutions (Barbezat, 1989; Barbezat & Hughes, 2001; Rippner & Toutkoushian, 2015; Toutkoushian, et al., 2007; Tuckman, 1976). Women and underrepresented minorities are disproportionately located at less-research intensive institutions, thus explaining a portion of the total salary gap (National Research Council, 2010; National Science Foundation, 2015a). Although it is clear that research intensity of an institution brings a pay advantage, it is less clear how the pay disparities among institutional types compare. Further, are there meaningful categorizations of institutions beyond research intensity when it comes to pay equity among women and underrepresented minorities in STEM?

This section offers three categorizations of institutions: 1) organizational identity, 2) organizational resources, and 3) level of decentralization in salary setting. The section begins with an overview of the traditional categorization of institutions—the Carnegie classification based on research intensity. Then, the three alternative categorizations are discussed and hypothesized with regard to how each categorization may influence pay disparities among women and underrepresented minority faculty in STEM.

[3] This discussion is on public and nonprofit four year colleges and universities. Other categories, which will not be discussed, are community colleges and for-profit institutions.

2.3.1 Growth and Classification of U.S. Higher Education Institutions

The Carnegie Commission on Higher Education began its classification system of U.S. post-secondary institutions in the 1970s to provide scholars with a means of accounting for institutional diversity in higher education research (The Carnegie Classification of Institutions of Higher Education, n.d.). The basic Carnegie classification captures the varying levels of research intensity across higher education. Scholars within the pay equity literature typically rely on Research, Masters, and Baccalaureate levels. Among the more than 4,600 higher education institutions in the U.S., almost 40 percent of institutions fall within those three categories (297 research, 724 masters, and 810 baccalaureate) (The Carnegie Foundation for the Advancement of Teaching, 2010). Doctoral-granting or research institutions confer at least 20 research/scholarship doctoral degrees annually (The Carnegie Foundation for the Advancement of Teaching, 2010). Masters colleges award at least 50 masters degrees annually, but fewer than 20 research doctorates. Finally, baccalaureate colleges award at least half of their degrees at the bachelor's level, but confer fewer than 20 doctorates or 50 master's degrees annually. Broadly, research universities are more selective, receive the majority of federal research support, and have larger budgets and endowments (Bok, 2013). Masters institutions are less selective, more diverse, and more often public (Bok, 2013). Baccalaureate institutions are often private with small student bodies. Liberal arts colleges—a subset of baccalaureate colleges—focus on undergraduate education in a residential setting (Oakley, 2005).

The Carnegie classification captures the diversity of higher education institutions, which have evolved in the U.S. to serve varied, yet overlapping purposes. Bok (2013) points to three main movements that advanced higher education beyond institutions focused on the moral and professional training of the elite—1) the advent of vocational training and degrees during the Industrial Revolution, 2) the establishment of a research orientation and PhD programs based on the German model at Johns Hopkins in 1876, and 3) the push for a humanities focus through liberal arts education. Prior to WWII, some institutions focused on a single purpose; however, following the war, institutions began to assume multiple purposes among those three (professional/vocational education, research, and liberal arts education) (Bok, 2013; Weisbrod, Ballou, & Asch, 2008). Two additional aims in more recent years have been economic development and service or technical assistance (Bok, 2013).

Faculty life varies among the institutional types, even as the institutions now have overlapping purposes (Wolf-Wendel & Ward, 2006). Although research, teaching, and service are faculty roles across settings, the institutional types place different emphases on those roles. Generally, teaching loads at universities can be half the load found at four-year colleges (Clark, 1987). In universities, faculty may teach or research exclusively, or do both, while also taking on consulting work and/or administrative work (Weisbrod, et al., 2008). A university professor can become "a professional man with his home office and basic retainer on the campus of the multiversity but with his clients scattered from coast to coast" (Kerr, 2001, p. 33). Faculty teaching at the university level may teach only graduates, while those in a four-year college may teach only undergraduates. Further, the university faculty can often shift a portion of the teaching duties—such as grading—to teaching assistants, thereby freeing more time for research (Clark, 1987).

Scientific fields contributed greatly to the divergent institutional types discussed above and offer clear evidence of variation in faculty life. The Morrill Act and the founding of the Department of Agriculture (both in 1862) began the land-grant college system that would become state universities and prompted agricultural and mechanical research at these institutions (Fox, 2008). Scientific fields led the way forward in specialization and graduate education and away from religious training of the original colleges (Fox, 2008). Following WWII, the federal funding of research further separated the work of universities and colleges, as universities (particularly the elite ones) shifted greater attention to research and graduate education (Weisbrod, et al., 2008).

Although graduate education, specialization, and research funding are associated with universities, academic scientists reside in all institutional types. Sixty-five percent of science, engineering, and health (SEH) doctorate holders employed full-time in academia are in research universities, while about 28 percent are in master's or baccalaureate institutions (National Science Foundation, 2015a).[4] Ruscio (1987) finds deep connections between selective liberal arts colleges and research universities as students matriculate from the colleges to graduate education in STEM fields at universities. This connection demonstrates the teaching differences—preparation of undergraduates at selective liberal arts colleges and preparation of undergraduates and graduates at the university level. For research, scientists in universities are more likely to receive external funding, providing access to laboratories and equipment that are often out of reach for scientists in the liberal arts setting (Ruscio, 1987). Research universities include research centers with teams of scientists and an administrative arm, while research among liberal arts scientists is more

[4] These figures include all full-time employees in academia who hold doctorates in science, engineering, and health fields. It potentially overstates the share of faculty in research universities given that the figures include postdoctorates and research assistants.

individualized (Ruscio, 1987). Finally, scientists in liberal arts colleges frame research as being a part of their work for students.

Among the few studies of pay disparities across institutional types, the gender pay gap is higher for research institutions than for liberal arts and master's institutions (Barbezat & Hughes, 2005; Lee & Won, 2014; National Academy of Sciences - National Research Council, 2001; Tolbert, 1986; Toutkoushian, 1998b). Porter and colleagues (2008) stand out as finding similar unexplained gender pay gaps of around 5 percent across institutional types, except for junior faculty who experience a greater gender gap in Research I institutions. In the one study examining race, the research intensity pattern does not hold, with insignificant racial pay disparities at most institutional types (Porter, et al., 2008). The exceptions were African American and Latino *junior* faculty experiencing a salary advantage in comprehensive institutions, yet not in other institutions; and, white faculty combined (junior and senior) experiencing higher salaries in liberal arts colleges than comparable non-white faculty. For STEM disciplines, the gender pay gap was larger at doctoral and research institutions in the 1970s through 1990s compared to liberal arts and master's institutions (National Academy of Sciences - National Research Council, 2001). The more recent STEM faculty pay study by the National Research Council was confined to Research I institutions; and thus, we have a 20 year gap since the 1995 findings.

Pfeffer and Ross (1990) offer the explanation that institutional differences in salary setting among the Carnegie classification types are due to the increasing complexity of work as research intensity grows. Described as a "multiversity" by Kerr (2001), modern universities are comprised of many communities, many purposes, and many constituencies, making performance measurement difficult (Weisbrod, et al., 2008). At the opposite end of the spectrum, liberal arts faculty demonstrate the most consensus on criteria for scholarship (Oakley, 2005). Thus building on Hickson's (1971) conception of uncertainty and substitutability, the greater task uncertainty at research institutions brings more complexity to performance evaluation, perhaps allowing discrimination to occur. Since it has been well-established that pay disparities vary by research intensity, such institutional influences will not be re-hypothesized but will be taken into account in the dissertation models.

The argument of this dissertation is that other institutional factors may influence pay disparities among women and minority STEM faculty beyond the traditional Carnegie classification. The Carnegie Classification offers the rational organizational logic of higher education institutions based on their activities, but fails to cover fully the breadth of organizational differences. The Carnegie Foundation itself notes that the Carnegie Classification "was not intended to be the last word on institutional differentiation" and, further, that "the host of intangibles that constitute *institutional identity* could not possibly be incorporated into an empirically based classification system" (McCormick & Zhao, 2005).

2.3.2 Institutional Identity

Academic reward structures may be formed under institutional pressures that cross Carnegie classification boundaries. Institutional theory explains the structure of organizations—and higher education institutions, in particular, given their unclear goals—as expressions of legitimacy, myth, ceremony, and mimicry (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Isomorphism occurs as organizations appropriate practices from the institutional environment, thus moving organizations to a similar structure regardless of purpose (Meyer & Rowan, 1977). Higher education institutions falling into a particular Carnegie category might still implement policies and practices that mimic other institutional types. For example, certain comprehensive or masters institutions are called “striving” as they push faculty to publish in hopes the institution will become a research university (Bok, 2013; Gardner, 2013; O'Meara, 2007; Wolf-Wendel & Ward, 2006). Fairweather (1993) found all institutional types to mimic the research university in valuing research over teaching in reward structures.

Although institutions may mimic research universities in rewarding research, it is unclear whether institutional pressures also work in the opposite direction. Do certain organizational identities lead institutions to seek pay equity? Organizational identity has been defined as the “central, distinctive, and enduring” features of the organization (Albert & Whetten, 1985, p. 265). In the labor market broadly, an organization’s identity can influence the conditions within the organization, including conditions between genders (Fagenson, 1990). In conceiving of an organizational identity that would relate to treatment of women and underrepresented minorities in higher education, the mission to serve those populations offers a core, stable, and distinctive identity compared to other institutions.

Women’s colleges and historically black colleges and universities (HBCUs) have distinct mission-driven identities compared to other institutions. Women’s colleges originated in the mid-1800s and have had a continued, albeit shrinking presence since that time (Women's College Coalition, 2015). The U.S. has 43 women’s colleges, down from 230 institutions in 1960 (National Center for Education Statistics, 2015a; Women's

College Coalition, 2015). These are all private institutions with undergraduate enrollments generally under 3,000 students (National Center for Education Statistics, 2015a). Although there are not studies comparing pay disparities at women's colleges to other institutions, one study examined salary data for a single women's college over 29 years (Berheide, Christenson, Linden, & Bray, 2013). The data displayed a persistent male salary advantage; however, the gender gap remained only for full professors in 2013 after equity raises resolved the disparity at the assistant and associate ranks. The authors speculate the remaining gap for full professors is due in part to women's slower progress to promotion to full professor.

HBCUs offer another mission-driven identity based on opening access to higher education and have been of particular interest to STEM scholars due to the institutions' contributions to the STEM pipeline (Stage, Lundy-Wagner, & John, 2013). By definition, HBCUs are institutions created between the Civil War and 1964 with the principle mission of serving African American students (Gasman, 2013). These institutions remained the only option for black students, for the most part, until the 1960s (Gasman, 2013). In 2014, more than 300,000 students attended 106 HBCUs (Toldson & Cooper, 2014). The mission is consistent across HBCUs as attested by their inclusion in the institutional category; however, the institutions differ substantially in several ways. Thirty-one HBCUs enrolled fewer than 1,000 students in 2013, while three institutions enrolled more than 10,000 students (Toldson & Cooper, 2014). About two-thirds of HBCUs have selective admissions, while one-third have open admissions. In comparing pay gaps at HBCUs and predominately white institutions (PWIs), Renzulli and colleagues (2006) argue that HBCUs should demonstrate greater equity based on their historical focus on inclusion. They find a smaller gender pay gap for associate professors; however, elite HBCUs show greater similarity to PWIs than non-elite HBCUs (Renzulli, et al., 2006).

Whereas women's colleges and HBCUs have a mission identity associated with a particular underserved population, other institutional categories serve minority populations without the mission-driven designation. Hispanic-Serving Institutions (HSI) and Predominately-Black Institutions (PBI) are defined in federal law based on composition (25 percent Hispanic and 40 percent black, respectively) (National Center for Education Statistics, 2015b). Institutions can gain or lose HSI or PBI designation depending on enrollment changes, thus making the group less cohesive than mission-driven minority-serving institutions (Contreras, Malcom, & Bensimon, 2008). Contreras and colleagues (2008, p. 74) point to the "unplanned and unstable nature" and "manufactured identity" of HSIs, leading the scholars to examine whether HSI missions reflect the designation. In examining mission statements of 10 HSIs, the authors found that while none explicitly mention HSI status, they all included at least one of following keywords: "diversity/diverse, culture/multicultural, and access" (Contreras, et al., 2008, p. 76). Actual mention of HSI designation appeared on institutional websites in discussing Title V programs and initiatives.

Although HSI and PBI institutions offer categorizations of minority-serving institutions and thus show some similarities to women's colleges and HBCUs, the question of interest here is the influence of an organization's history and identity of inclusion on pay equity.[5] Thus, the dissertation focuses on mission-driven focus on

[5] Tribal Colleges are another category of institutions; however, they are predominately two-year institutions.

inclusion in keeping with institutional theory rather than gender or racial composition of the institutions, which would follow structural theory. The hypothesis is:

H1a: Pay disparities among STEM faculty will be lower in institutions with a mission of serving underrepresented groups.

The categorization of public and private institutions offers another lens of institutional culture, history, and policies that goes beyond the Carnegie classification of research intensity. In examining higher education mission statements, Morphew and Hartley (2006) found that institutional control (i.e., public/private status) mattered more than research intensity. Public institutions were more similar to each other in their espoused purposes regardless of institutional type, and likewise private institutions to other private institutions. Mission statements for public institutions more frequently included diversity and service to local communities, while private institutions more frequently noted religious affiliation and liberal arts education. Public institutions have a mission of access; however, the decline in public funding has led some public institutions to move toward a private model, wherein tuition and selectivity are more highly regarded (Benefits of Institutional Diversity, 2013).

The public/private dichotomy has a long history in the organizational and public administration literature (Rainey & Bozeman, 2000). Generally, the public sector has been characterized as more egalitarian, transparent, and regulated in terms of hiring, promotion and rewards (Goodsell, 2015; Mandel & Semyonov, 2014). While studies have shown differences between public and private organizations, those differences are subject to the sector (Rainey, 2011)—meaning, they may or may not be generalizable to higher education. In the labor market broadly, the gender pay gap is lower in the public sector; however, the public sector's shrinking gap stagnated in 2000 while the private sector's gap continued to lessen (Mandel & Semyonov, 2014). In academia, Tolbert (1986) found greater gender pay disparity in private institutions, arguing that private institutions are insulated and therefore can discriminate. It is unclear whether Tolbert's findings in the 1980s will continue to hold today, particularly in the STEM disciplines. Recent research has shown benefits to women scientists' productivity from being in private organizations that use a team-based or network approach compared to a more formalized, bureaucratic public organization (Whittington & Smith-Doerr, 2008). However, the comparison for this dissertation will be public to private, nonprofit institutions within a single industry—higher education—rather than public organizations to private industry. Thus, the hypothesis will rely on traditional conceptions of public sector organizations as more equitable. While this hypothesis draws on organizational mission of access, it should be noted that another explanation could be the greater personnel constraints generally found in the public sector (Rainey, 2011):

> *H1b*: Pay disparities among STEM faculty will be greater in private institutions than in public institutions.

2.3.3 Organizational Budgeting

Reward structures may vary across institution types due to research complexity and institutional identity, but salary-setting is also part of an organizational budgetary decision-making process. Thus, organizational resources, as well as power to employ those resources, may also explain a portion of salary inequality. In decision-making processes, organizations cope with uncertainty and instability, as problems, participants, and solutions shift in and out of the process (Cohen, March, & Olsen, 1972). In addition, participants bring conflicting goals and priorities, thus making rational decision-making difficult (Pfeffer & Salancik, 1974; Salancik & Pfeffer, 1974). The uncertainty and instability in decision-making processes creates the opportunity for other factors—such as power—to enter into budgetary processes. Resource dependency theory states that organizations are open systems dependent on flows of resources (Salancik & Pfeffer, 1974). Organizational subunits derive their power through their ability to generate external resources, and in turn, use that power to acquire additional internal resources. Findings at the disciplinary, departmental, and individual level show that the acquisition of external resources (e.g., grant-getting ability) influences resource allocation (National Research Council, 2010; Umbach, 2007; Volk, Slaughter, & Thomas, 2001).

The concern over resources has been a dominant theme in higher education discussions in recent decades. State and local support for higher education per full-time equivalent peaked in 2001 in constant dollars (State Higher Education Executive Officers Association, 2014). State and local support in FY 2014 remained below levels in FY 2009, in nominal dollars. Looking to the past 25 years, inflation-adjusted state and local support per FTE declined by 24 percent. Tuition has bridged that gap, with 107 percent growth in public institutions' tuition in constant dollars over the 25 year period. Even for private institutions, which are less reliant on state and local support, funding concerns are prevalent given pressures for affordable or competitive tuitions and recessionary-hits to endowments and giving (Ehrenberg, 2011). The following discussion offers hypotheses on the influence of organizational resources and power on faculty pay at the institutional-level.

2.3.3.1 Organizational Resources

Institutions compete for prestige in order to garner resources—in part to attract star faculty and further bolster their reputation (Bok, 2013; Brewer, Gates, & Goldman, 2002). Research universities receiving the lion's share of federal grant support have been called "Federal Grant Universities" (Kerr, 2001; Thelin, 2013), while selective and financially-stable liberal arts have been termed "medallion colleges" (Lapovsky, 2005). Masters institutions also demonstrate this division, with certain institutions being termed "striving institutions" as they attempt to move to the research university level through such means as faculty recruitment (O'Meara, 2007). In contrast, the regional or metropolitan masters institutions are less concerned with prestige (Bok, 2013; Wolf-Wendel & Ward, 2006). Thus, within each Carnegie classification institutional type there exists a range of institutions that are competing for prestige and top faculty both within and across institutional types. These well-funded institutions are aggressive in faculty recruitment, leading less-resourced institutions to increase salaries to keep top faculty (Duderstadt, 2000).

Categorizing institutions by their financial resources is another grouping that might help identify the span of inequity across institutional types. Ehrenberg (2011, p. 15) argues that wealth sets certain institutions into "a world of their own," given their ability to hire and retain tenured faculty. Endowment size explains more than 75 percent of the variance in average faculty salaries in private research universities and more than 80 percent in private liberal arts institutions (Ehrenberg, 2003). Within public universities, endowment size matters as well to average salary; however, the level of state appropriations per student influences average salaries more (Ehrenberg, 2003). Ehrenberg and Smith (2003) further find that those institutions with the largest endowments per student receive larger private gifts and invest such gifts back into the endowment at a higher rate, possibly creating an escalating gap between institutions in terms of endowment resources in coming years and thus ability to pay faculty.

Tolbert (1986) examined the influence of total institutional resources as a measure of slack resources, hypothesizing that slack resources would allow an institution to discriminate in faculty salary-setting due to the insulation and security those slack resources provided. Indeed, she found that wealthier institutions, as measured by revenues per student, demonstrated a larger gender gap in earnings. Pfeffer and Ross (1990) measured resources through factors constructed from several ratios—faculty per student, budget per student, staff per student, budget per faculty, and staff per faculty—but did not find significant impacts of resources on gender equity among *college administrators* in cross-sectional models. However, in longitudinal analysis, faculty resources (budget per faculty and staff per faculty) contributed to male salary advantage, leading the authors to assert a slack resources argument. The hypothesis is:

> *H2a:* Pay disparities among STEM faculty will be higher in institutions with greater institutional resources.

Alexander (2001) argues that competition for top faculty relies on an institution's ability to raise private funds from which they can provide competitive salaries. Thus, it may not be only the level of wealth but also the mix of resources that influences faculty salaries. Again, certain institutions are pulling away from each other in private funding, leading Kerr (2001, p. 188) to prophesize that the "federal research grant university" will one day be the "private grant university." This issue of private resources is particularly relevant at research-oriented institutions, given their history of larger endowments, greater ability to raise tuition, and stronger links with government and industry research support (Geiger, 2009).

Higher education institutions are characterized as public or private; however, both types of institutions rely on public and private support (Geiger, 2009). At public, four-year institutions, the revenue composition is 22 percent from tuition, 4 percent from investments, 38 percent from government sources, and 36 percent from other sources (National Center for Education Statistics, 2015c). At private, nonprofit four-year institutions, those breakdowns are 32 percent from tuition, 19 percent from investments, 13 percent from government sources, and 36 percent from other sources. As Duderstadt (2000, p. 45) notes: "In summary, public and private universities are becoming remarkably similar in the way that they are financed. In fact, there are many private institutions that receive far greater public subsidies—particularly when tax exemptions on gifts or endowment appreciation are included—than some public universities!"

The previous hypothesis (H1b) focused on the influence of public/private status, which captures institutional ownership but fails to address dimensional "publicness"—the spectrum of public reliance among organizations (Bozeman, 1987; Bozeman & Bretschneider, 1994; Rainey, 2011). Research distinguishing the public sector and dimensional publicness demonstrates that the two constructs are distinct and lead to different outcomes (Rainey, 2011). In relation to pay disparities, we can conceive of publicness as having two effects through competition and accountability. If, as Alexander (2001) contends, private funds aid in competition for faculty, then lower levels of resource publicness (or conversely, higher levels of privatization) may mean prestige rather than equity motivates salary decisions. In contrast, resource publicness has been associated with government accountability requirements (Rainey, Pandey, & Bozeman, 1995), thereby raising the possibility of greater pay equity given higher accountability. The hypothesis is:

H2b: Pay disparities will be higher in institutions that rely less on public funding.

2.3.3.2 Organizational Power and Formalization

The power to distribute resources offers a final organizational mechanism for pay inequity. Pay systems can be more or less formalized, granting varying levels of discretion to managers in setting salaries. Based on Weber's conceptualization, bureaucratic models should lower unequal outcomes by limiting managerial discretion, although there is some recent evidence that certain reforms to limit managers can have adverse effects (Dobbin, Schrage, & Kalev, 2015; Reskin, 2003). Discretion introduces bias by allowing individual level characteristics, such as negotiation skills and additional job offers, to influence salary—characteristics that are often purported to be at play but rarely studied (Pfeffer & Ross, 1990). Formalization of human resource practices for pay and promotion can reduce bias and inequality, although the effects can be sensitive to the organizational context (Blau & Kahn, 1999; Doucet, Smith, & Durand, 2012; Elvira & Graham, 2002; Stainback, et al., 2010; Warman, et al., 2010; Wharton, 2015; Whittington & Smith-Doerr, 2008).

For universities, decentralized decision-making has been a hallmark of the importance of faculty (Fox, 2008). Fox (2008) notes that science and engineering faculty, in particular, can command autonomy, given their vital role in securing external funding and contributing to the prestige of the institution, drawing on the resource dependence framework. Although universities have long valued decentralized decision-making—particularly in light of the rise of the research university (Geiger, 2009)—they are not fully decentralized, at least on budgetary matters. Only 6 percent of STEM department chairs report full authority in granting salary increases to job candidates (Bozeman, Fay, & Gaughan, 2013). More than 85 percent of university CFOs report using incremental or formula-based budget models for their institutions, while 14 percent cite Revenue Centered Management (RCM)—a decentralized budgeting model that provides more autonomy to subunits (Green, 2011).

Thus, budgetary discretion varies across institutions, providing the opportunity to test the relationship between discretion and pay equity observed in the broader labor market. Within universities, the power and discretion of the department head is of particular concern. Wharton (2015, p. 13) claims the department chair is the "most critical" leader for faculty, given the chair's influence on practices, relationships, and job satisfaction, among others. Chairs manage resources, hire and evaluate faculty, guide departmental goals and cultures, and do this often without training or experience in administrative roles and while still identifying as faculty rather than administrators (Carroll & Wolverton, 2004; Gmelch, 2004; Schuh & Kuh, 2005). The power of the department head as a potential source of inequity has not been tested, but rather suggested by those in the field:

> The only truly effective remedy for inequity is the adoption of more standardized (and open) methods of determining initial salaries, increases, and special awards. As long as salaries are determined primarily by private individual negotiation or administrative discretion, inequities will reemerge. (Curtis, 2010)

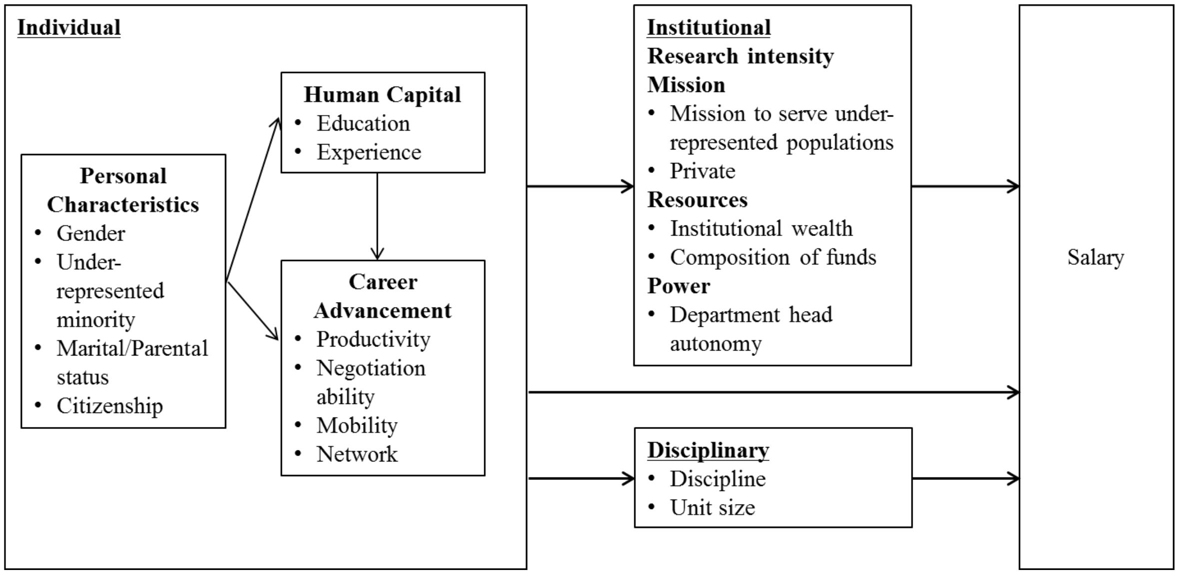
The hypothesis is:

H3: Pay disparities among STEM faculty will be greater in institutions with more autonomous department heads.

2.4 Summary and Conceptual Model

The dissertation incorporates organizational influences on pay equity into the traditional human capital and disciplinary frameworks of faculty salary studies. Umbach (2008) offers a similar framework in studying the influence of female representation at the institutional and disciplinary level on salaries. The dissertation offers a modification of Umbach's model given the institutional factors of interest (Figure 2.1). The three levels of predictors of faculty salaries are: 1) individual characteristics typically found in the human capital models reviewed in Section 2.2, 2) structural characteristics relating to discipline and unit size also reviewed in Section 2.2, and 3) organizational characteristics of mission, resources, and power hypothesized in Section 2.3. Gender and race/ethnicity are purported to influence each of these levels.

Figure 2.1 **Conceptual Model of Factors Affecting STEM Faculty Salary**



The hypotheses, summarized in Table 2.2, argue that organizational setting influences pay disparities among women and underrepresented minority STEM faculty. Drawing on institutional theory, hypotheses 1a and 1b suggest that organizational identity will lead certain institutions to focus on equity more so than other institutions, and this identity will influence salary-setting. These institutions with a mission or identity of access are women's colleges, HBCUs, and public institutions. Competition rather than equity will drive certain institutions in their salary-setting activities, according to hypotheses 2a and 2b. Slack resources in the form of greater institutional resources and private resources provide the means for institutions to pull away from other institutions in their ability to attract and retain faculty. Thus, the dissertation hypothesizes that gender and racial pay disparities among STEM faculty will be greater in wealthy institutions, as well as those more reliant on private funds. Finally, decentralization of salary decision-making has led to greater pay disparities in other industries, yet has not been studied within higher education. Hypothesis 3 argues that institutions providing more autonomy to department chairs in salary-setting will have greater pay disparities among women and underrepresented minority STEM faculty.

Table 2.2 **Summary of Hypotheses**

Hypotheses	
Mission	*H1a*: Pay disparities among STEM faculty will be lower in institutions with a mission of serving underrepresented groups.
	H1b: Pay disparities among STEM faculty will be greater in private institutions than in public institutions.
Resources	*H2a:* Pay disparities among STEM faculty will be higher in institutions with greater institutional resources.
	H2b: Pay disparities will be higher in institutions that rely less on public funding.
Power	*H3:* Pay disparities among STEM faculty will be greater in institutions with more autonomous department heads.

CHAPTER 3: DATA AND METHODS

3.1 Introduction

This dissertation argues that institutional factors, in combination with human capital and disciplinary factors, influence pay equity among STEM faculty. The hypotheses presented in the previous chapter posit that institutional mission, resources, and power contribute to pay disparities among women and underrepresented minority STEM faculty. This chapter explains the data sources, variable operationalization, descriptive statistics, and methodology used to examine those relationships.

3.2 Data Sources

3.2.1 NETWISE II Survey

The primary data source is the 2011 NETWISE II Phase I Survey, conducted under a grant from the National Science Foundation (NSF Grant # DRL-0910191).[6] The purpose of the survey was to advance understanding of network structures and career outcomes for academic scientists and engineers, with particular attention to women and underrepresented minorities. The survey offers several advantages, including the concentration on STEM faculty, a sampling strategy focused on underrepresented groups and institutions targeting those groups, and more recent salary data than other surveys. The population for the survey was tenured and tenure-track faculty in U.S. institutions in four disciplines demonstrating varying levels of female representation: biochemistry (high female), biology (high female), civil engineering (low female), and mathematics (medium female). The administrators drew a sampling list of 25,928 faculty from the following institutional types: Research Extensive and Intensive institutions, women's

[6] NETWISE II Phase One Codebook v3, March 2014. For more information on the project team and project publications, see http://NETWISE.gatech.edu/overview.php.

colleges that house the four disciplines of interest, all Hispanic-serving institutions (HSI),[7] HBCUs identified in the White House Initiative,[8] Oberlin 50 baccalaureate institutions,[9] and a 15 percent sample of Master's I/II institutions.[10] The survey designers focused on the Oberlin 50 baccalaureate institutions, since they are more selective institutions and contribute disproportionately to the STEM pipeline (Burrelli, Rapoport, & Lenming, 2008). The Masters institutions were limited to a 15 percent sample due to the number of institutions (611). In total, there were 527 institutions represented in the sample consisting of 149 Research Extensive, 110 Research Intensive, 96 Master's, 50 Oberlin, 49 HSI, 43 HBCU, and 19 women's colleges.[11]

In addition to institutional type, the sampling strategy focused on gender, race, and discipline, with fields selected based on high, low, and transitioning proportions of women. Survey administrators identified the 25,928 faculty as male or female based on name and online photos, when available, as well as potentially nonwhite based on photos.[12] The faculty list was divided among 112 cells for combinations of the seven institutional types, four departmental types, two genders, and two racial categories (minority/nonminority). To increase minority representation in the survey, the administrators also relied on a snowball technique. Self-identified under-represented minority respondents from the original random sample provided names of other faculty of

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[7] Hispanic-serving institutions are defined as institutions in which Hispanic students comprise at least 25 percent of the full-time undergraduate student body. (See U.S. Department of Education definition here: http://www2.ed.gov/programs/idueshsi/definition.html.)

[8] White House Initiative on Historically Black Colleges and Universities, List of Schools. http://sites.ed.gov/whhbcu/one-hundred-and-five-historically-black-colleges-and-universities/.

[9] Burrelli, Joan, et al. (2008). Baccalaureate Origins of S&E Doctorate Recipients. NSF 08-311. http://www.nsf.gov/statistics/infbrief/nsf08311/#fn5 . (See Note 5 for list of colleges.)

[10] The administrators relied on the 2000 Carnegie-classification, which has the four categories of Research Extensive, Research Intensive, Masters, and Baccalaureate based on research intensity. For further explanation of institutional classifications, see Chapter 2 of this dissertation.

[11] The 527 institutions in the sampling frame represent 48 percent of the overall institutions in the categories of research, masters, and liberal arts institutions from the 2000 Carnegie-classification.

[12] NETWISE II Phase One Codebook v3, March 2014

the same race, which allowed administrators to identify additional minority faculty for a second round of the survey. The final stratified random sample included 9,925 faculty from 527 institutions, stratified by institutional type, departmental type, gender, and minority status. A total of 4,313 faculty from 487 institutions completed or partially completed the online survey; however, survey administrators removed 117 of those responses due to ineligible discipline or rank. Thus, there are 4,195 completed or partially completed responses, and 3,559 complete responses. The response rate is 40.4 percent.

Given the centrality of race to this dissertation, it is important to clarify the NETWISE survey's treatment of race/ethnicity. The data rely on self-reported race/ethnicity based on two questions. The first question asked for a yes/no response to: "Do you consider yourself to be of Hispanic, Latino, or Spanish origin?" The second question asked the respondent's race and provided the options of White, Black or African American, American Indian or Alaskan Native, Asian, and Other. For respondents indicating "Other," the survey provided an open-ended option for respondents to explain further. The survey administrators created a dummy variable for each racial category. Thus, a respondent answering White and Black to the "Other" category was coded as White, Black, and Other. Additionally, the administrators created a single race variable with mutually exclusive categories. For this variable, that same respondent would be coded as Other. There were 74 missing responses (1.8%) for race/ethnicity. For gender, 54 respondents did not provide an answer. The survey administrators coded those 54 missing cases for gender based on the sampling population file, photos, and respondent self-identification as male or female.

Table 3.1 **NETWISE II Survey Respondent Characteristics**

Characteristic	Percent
Gender	
Male	56.8
Female	43.2
Race/Ethnicity	
White	61.0
Asian	23.1
African American	7.1
Hispanic	5.6
Other	1.1
Native American/Alaskan	0.4
Unknown	1.8
Institutional Type	
Research Extensive	29.6
Research Intensive	21.0
Masters	31.5
Liberal Arts	17.6
HIS	11.1
HBCU	8.7
Women's colleges	4.7
Discipline	
Biology	33.9
Math	28.1
Civil Engineering	19.1
Biochemistry	17.1
Other STEM	1.7
N = 4,195	

Note: The institutional types based on Carnegie-classification research intensity (Research Extensive, Research Intensive, Masters, and Liberal Arts) are mutually exclusive and add to 100 percent. However, the three other institutional types are not mutually exclusively. All HBCU, women's colleges, and HSIs are also categorized among Research Extensive, Research Intensive, Masters, and Liberal Arts. Women's colleges have 13 Liberal Arts institutions and 6 Masters institutions. HBCUs are 1 Research Extensive, 6 Research Intensive, 25 Masters, and 11 Liberal Arts. HSIs are 3 Research Extensive, 4 Research Intensive, 40 Masters, and 2 Liberal Arts. Among the three institutional types (HBCU, HSI, and women's college), there is one institution that is both an HBCU and women's college. There are no institutional overlap with HSIs, however. The disciplines are the departments in which faculty work. Data are not weighted.

3.2.2 Additional Data Sources

In addition to the survey data, several other data sources provide useful institutional and budget data critical for the analysis. National Center for Education Statistics Integrated Postsecondary Education Data System (IPEDS) Delta Cost Project provides data on institutional resources (i.e., total revenue and public revenue) for Hypotheses 2a-b

(National Center for Education Statistics, 2015b). The Delta Cost Project revises financial data institutions report using FASB and GASB standards. These revisions make comparisons possible between the two reporting types. The data are for 2012. The analysis links the institutional resources data from the IPEDS Delta Cost Project to the individual survey response data from NETWISE II based on institution.

The 2010 Survey of Academic Chairs/Heads provides data on the influence of department head power on salary-setting.[13] The sampling population (1,832) was department chairs of STEM disciplines at Carnegie Extensive universities. The survey had 765 responses for a response rate of 43 percent. Given that the Chairs Survey focused on Research Extensive universities only, the sample size for models testing the organizational power hypothesis (Hypothesis 3) are much smaller than other models. The analysis creates an institutional-level power measure, as described in the variable operationalization, based on the average power measures of department heads within the institution who participated in the survey. The analysis links the institutional-level power measure to faculty from the NETWISE II Survey. Thus, faculty from the NETWISE II Survey who do not have a match are removed from the portion of the analysis dealing with decision-making autonomy.

3.2.3 Missing Data and Final Samples for Analyses

Missing data—a common occurrence in survey collection—can lead to a loss of statistical power or biased estimates (Wooldridge, 2003, p. 317). The key concern for this dissertation is missing data for the question of interest—salary. The NETWISE II Survey asked for salary information as one of the final questions. The majority of respondents

[13] Survey of Department Chairs/Heads Codebook. July 1, 2011. The Chair Survey was supported by NSF #0710836 under the lead of Principal Investigator Monica Gaughan, University of Georgia. The Survey was conducted in spring and summer of 2010.

who partially completed the survey stopped long before the salary question. Of the 4,195 respondents at least partially completing the survey, 931 respondents (22.2%) did not answer the salary question. Of the 3,559 respondents completing the survey, 295 respondents (8.3%) did not answer the salary question. The 8.3 percent non-response rate among those completing the survey is better than recent NSF non-response rates on salary for biology, civil engineering, and math faculty in research institutions (12.4% to 20.6%) (National Research Council, 2010). Table 3.2 displays the percentage of each group who did not answer the salary question for both the total respondents (partially and fully completed surveys) and the respondents who fully completed the survey.

Additional respondents lacked responses to other questions of interest and were removed. The final sample for models testing hypotheses 1 and 2 is 2,352 respondents. The final subsample for models testing hypothesis 3 is 736 respondents. The analysis weights the final samples using probability weights. The weighted full sample is 29 percent female and 8 percent underrepresented minority. Females comprise a slightly lower share of the subsample (27% compared to 29% in the full sample), but the share of underrepresented minorities remains the same (8%). As shown in Table 3.3, these shares are consistent with NSF data of 27 percent female and 8 percent underrepresented minority tenured or tenure-track professors in biology, math, and engineering (National Science Foundation, 2015a).

Table 3.2 **Percentage of NETWISE II Respondents Who Did Not Provide Salary Data**

Characteristic	**Percent of Total Respondents**	**Percent of Respondents with Completed Surveys**
Total Missing Salary	***22% (N=931)***	***8.3% (N=295)***
Gender		
Male	23	9
Female	21	7
Race/Ethnicity		
White	18	6
African American	23	8
Native American/Alaskan	17	6
Asian	32	15
Hispanic	17	3
Other race	25	13
Institutional Type		
HBCU	29	13
Women's colleges	20	9
Masters	19	6
Research Intensive	22	8
Research Extensive	26	10
Liberal Arts	14	6
HSI	23	7
Discipline		
Biology	18	5
Biochemistry	18	6
Civil engineering	27	11
Math	27	12
Other STEM	25	8

Note: Data are not weighted.

Table 3.3 **Distribution of Respondents in Final Sample and STEM**

Characteristic	Percent in Full Sample	Weighted Percent in Full Sample	Percent in Subsample	Weighted Percent in Subsample	Percent in STEM Overall
Gender					
Male	56.1%	70.7%	50.5%	72.8%	73.5%
Female	43.9	29.3	49.5	27.2	26.6
Race/Ethnicity					
White	68.9	79.5	60.5	78.8	73.2
African American	5.6	2.9	5.4	2.3	2.4
Native American/Alaskan	0.5	0.7	0.3	0.7	--
Asian	18.9	12.1	25.1	12.6	18.7
Hispanic	5.4	4.4	7.9	5.1	4.1
Other race	0.7	0.5	0.8	0.5	--
Observations	Full Sample N=2,352		Subsample N=736		

Note: Percentages in STEM overall are based on faculty in four-year institutions in the fields of biology, mathematics, and engineering at the full, associate, and assistant rank. Source: Author's calculations using National Science Foundation, National Center for Science and Engineering Statistics, Survey of Doctorate Recipients, 2013, Tables 17 and 19.

3.3 Variable Operationalization

3.3.1 Dependent Variable

The dependent variable for all models in this analysis is self-reported *salary*. Salary studies often rely on the natural logarithm of salary to account for the nonlinear relationship between salary and independent variables such as education, allowing a percentage change rather than constant dollar change in salary given changes in the independent variables (Wooldridge, 2003, pp. 43-44). An analysis of the model fit with salary and the natural log of salary, however, demonstrated that salary was a better fit for the models in this dissertation. Data on salary come from the NETWISE II Survey question: "What is your approximate annual salary *excluding* summer appointments?" There are some limitations to this question. Academic salaries are comprised of base contracts (9-month), extended contracts (11 or 12-month), extended pay (e.g. additional teaching load), and external pay (e.g. consulting contracts) (Bowen and Schuster 1986 in

Park, 2011). The models include a dummy variable for 12 month contract to account for this variation in contract length that may affect salary.

3.3.2 Key Independent Variables

The key independent variables are demographics, institutional identity, organizational resources, and organizational power. For demographics, the independent variables are *gender* and *race/ethnicity*, as described in Table 3.4, from the NETWISE II Survey. Gender is a dummy variable "Female," coded 1 for female and 0 for male. Race is a dummy variable "Underrepresented Minority" (or URM) coded 1 by NETWISE Survey administrators for underrepresented minorities (African-American, Hispanic, or American Indian/Alaskan) and 0 for non-underrepresented minorities (White, Asian). This variable operationalization draws on NSF's definition of underrepresented minority in science and engineering as African Americans/Blacks, Hispanics, and American Indians. These racial/ethnic groups are classified as underrepresented, along with women and persons with disabilities, because their science and engineering degrees and employment are lower than their population shares (National Science Foundation, 2013). In addition, the analysis tests separate models that disaggregate race/ethnicity into a set of dummy variables: African-American/Black, Asian, Hispanic, White, and Other Race. White serves as the reference group.

The two *institutional identity* variables are dummy variables based on institutional variables included by the NETWISE II Survey administrators from Carnegie-classification. For Hypothesis 1a, institutions are classified as having a mission of serving underrepresented populations through a dummy variable "HBCU/Womens" coded 1 for faculty in HBCU or women's colleges institutions and 0 for faculty in all other institutions. For Hypothesis 1b, all institutions are classified by their private or public status through the dummy variable “Private,” coded 1 for private institutions and 0 for public institutions.

For *organizational resources*, Tolbert (1986) relies on per student total revenues. Similarly, the interval-level variable “Revenues per FTE” in H2a measures institutions’ stable operating revenue divided by total fall full-time equivalent (FTE) student enrollment from the IPEDS Delta Cost Project data.[14] For the share of revenues from public sources in H2b, the variable “Percent of revenue from public sources” measures federal, state, and local funds from all sources (appropriations, grants, contracts) divided by total revenues.[15]

To measure *organizational power*, the dissertation relies on a power-index created by Bozeman, Fay, and Gaughan (2013) based on the ability of department heads to offer additional incentives to job candidates. The authors created the index based on responses to 12 questions regarding various available incentives—additional salary, course reductions, teaching assistants, summer money, research money, research assistants, start-up money, spousal hiring assistance, computing software, laboratory space, laboratory supplies, moving expenses, and travel funds. The department chair respondents described their ability to offer these incentives as “1) no outside involvement needed, 2) requires

[14] Stable operating revenue includes: “Total revenue including revenue from auxiliary, hospitals, and other independent operations. Includes the sum of tuition; federal, state, and local appropriations, grants, and contracts; auxiliaries; hospitals; and other independent operations; excludes revenues from affiliated entities, private gifts, grants, and contracts; investment return; endowment earnings.” IPEDS Delta Cost defines total fall FTE student enrollment (“fte_count”) as: “Full-time equivalent enrollments are derived from the enrollment by race/ethnicity section of the fall enrollment survey. The full-time equivalent of an institution's part-time enrollment is estimated by multiplying part-time enrollment by factors that vary by control and level of institution and level of student; the estimated full-time equivalent of part-time enrollment is then added to the full-time enrollment of the institution. This formula is used by the U.S. Department of Education to produce the full-time equivalent enrollment data published annually in the Digest of Education Statistics.” (Source: Delta Cost Project Data Dictionary, https://nces.ed.gov/ipeds/deltacostproject/)
[15] The measure comes from IPEDS Delta Cost Project “govt_reliance_a” variable, defined as: “The federal, state, and local appropriations, grants, and contracts share of operating revenue (net tuition; federal, state, and local appropriations, grants, and contracts; and private gifts, grants, and contracts).” (Source: Delta Cost Project Data Dictionary, https://nces.ed.gov/ipeds/deltacostproject/)

Dean’s involvement, 3) requires Provost/VP involvement, 4) requires President’s involvement, or 5) not available” (Gaughan, 2011, p. 17). The index measures how many of those incentives a department head can offer with “no outside involvement needed”—meaning, the department head has full power to offer the incentive.

The analysis converts those individual power indices in the Chair Survey database to an average power index by institution since individual department chair respondents cannot be matched directly to NETWISE II Survey responses of faculty. The dissertation averages the Power Index from the Survey of Department Chair respondents for each institution, then links the institutional-level average power index to faculty in the NETWISE II Survey in the continuous variable “Department head discretion.” Thus, the independent variable “Department head discretion” measures whether a faculty member from the NETWISE II Survey works in an institution that offers higher or lower power to STEM department chairs with regards to independently negotiating with job candidates.

Table 3.4 **Hypotheses and Operationalization of Dependent and Key Independent Variables**

Hypotheses	Variable	Operationalized Variable
Institutional Identity		
H1a: Pay disparities among STEM faculty will be lower in institutions with a mission of serving underrepresented groups than in other institutions.	Salary *(dependent variable for all hypotheses)*	[C] Salary
	Female *(independent variable for all hypotheses)*	[0,1] Coded as 1 for female, 0 for male
H1b: Pay disparities among STEM faculty will be greater in private institutions than in public institutions.	Underrepresented Minority (URM) *(independent variable for all hypotheses)*	[0,1] Coded as 1 for Underrepresented Minority (African American/Black, Hispanic, and American Indian/Alaskan), 0 otherwise Models also test disaggregated race/ethnicity with a set of dummy variables: African American/Black, Asian, Hispanic, White, and Other Race.
	HBCU/Women's	[0,1] Coded as 1 for women's college or HBCU, 0 otherwise
	Private	[0,1] Coded as 1 for Private institution, 0 for Public institution
Resources		
H2a: Pay disparities among STEM faculty will be higher in institutions with greater institutional resources.	Revenues per FTE	[C] Total revenue (with auxiliary, hospital, independent operations, and other sources) / Total fall FTE student enrollment
H2b: Pay disparities will be higher in institutions that rely less on public funding.	Percent of revenue from public sources	[C] Revenue from federal, state, and local appropriations, grants, and contracts / Total revenue
Power		
H3: Pay disparities among STEM faculty will be greater in institutions with more autonomous department heads.	Department head discretion	[C] Interval variable measuring the average discretion given to STEM department heads in the faculty's institution. The power index for each institution is an average of individual power indices, which measure the ability of STEM department chairs in research universities to offer 12 job incentives to candidates without outside involvement.

Note: [0,1] denotes a dummy variable or set of dummy variables. [C] denotes a continuous variable.

3.3.3 Control Variables

In addition to the independent variables, the analysis includes control variables for personal/family characteristics, career advancement, human capital, department, and institutional type drawn from data in the NETWISE II Survey. Table 3.5 summarizes these control variables.

3.3.3.1 Personal Characteristics

As discussed in Chapter 2, marriage and family have complex influences on faculty pay. In academia overall, married male faculty earn higher salaries than comparable non-married male faculty, while the findings are mixed for women (Toutkoushian, 1998a; Toutkoushian, et al., 2007). The control variable for *marital status* is a set of three dummy variables for relationship status: married or living in a marriage-like relationship; divorced, widowed, or separated; single. *Parental status* has been suggested as a penalty for female faculty, as female scientists and engineers cite "family responsibilities discrimination" (National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2006). Having dependents has been found to benefit male faculty in promotion, but did not influence female faculty promotion in academia overall (Perna, 2005). The control variable for parental status is a dummy variable coded 1 for respondents who said they have cared for dependent children since being a faculty member at the institution. Given that the effects of marital status and parental status tend to vary by gender, the analysis includes interaction terms between those control variables and gender. Further, models are run with and without those controls. Finally, the analysis controls for *nativity* with a dummy variable "Foreign-born," coded 1 for those responding they are foreign-born.

3.3.3.2 Human Capital

For human capital factors, faculty salaries increase with education and experience (Barbezat & Hughes, 2005; National Research Council, 2010; Perna, 2005; Toutkoushian, et al., 2007; Umbach, 2007). Higher education scholars typically control for *experience* and on-the-job training through years since PhD receipt and years within current position (Perna, 2005). This analysis relies on years since PhD alone, given the high correlations between years since PhD and years within current position. Initial analysis included a variable measuring years of experience squared to test whether the relationship of experience to salary was nonlinear; however, the squared term did not improve the fit of the model and was excluded from further analysis. In addition, the analysis will include post-doctoral appointments and non-academic work experience, given the prevalence of those career paths among STEM faculty (M.-W. Lin & Bozeman, 2006; National Science Board, 2014).

3.3.3.3 Career Advancement

Career advancement variables capture the mobility, productivity, negotiation ability, and network aspects of faculty careers. As products of human capital, *productivity* and *mobility* contribute to earnings gaps in the labor market broadly. “Mobility” measures the number of tenure track positions held at other institutions. Productivity measures include five types—publication productivity, grant productivity, teaching productivity, service productivity, and overall hours worked. For publication productivity, the “Journal articles” variable is the number of peer-reviewed journal articles in the prior two years. The survey data do not provide career publications, which is a more typical productivity measure in faculty pay studies. Grant productivity is the total dollar amount of external research grant awards. Teaching productivity, which typically decreases salary among faculty (Perna, 2003), is the percentage of time spent on teaching. Several measures of service productivity are included as dummy variables: current or past chair or dean, current director of a research center or institute, and current chaired professorship. Finally, as discussed in Chapter 2, Goldin (2014) suggests that number of hours worked contributes to gender salary gaps in academia, due to its effects on productivity. Thus, the final control for productivity is average weekly hours worked.

In addition to the mobility and productivity controls, the analysis includes *negotiation* and *network* controls as possible contributors to career advancement. It has been suggested that male faculty have better negotiation skills than female faculty, contributing to the pay gap (American Association of University Women, 2014). The variable "Negotiation ability" is a dummy variable coded 1 for respondents who asked for additional salary in their first job offer and received all of the request.[16] "Network ties" is a measure created by the NETWISE II Survey administrators based on the number of individuals identified by the survey respondent as being in their network. These ties are not just collaborators, and thus is not a proxy for productivity. Instead, the measure includes individuals identified as collaborators, as well as those individuals who respondents go to for advice and career mentorship. Networks can influence salary through collaborative effects, but also through access to career information, opportunities, and guidance (National Research Council, 2010).

[16] The analysis tested two additional operationalizations of the negotiation variable. First, it combined those who asked for more money and received *some* of it and those who received all of their request, coding those respondents as 1 for asking and receiving at least some of their request. The next option added respondents who asked for more money and did not receive it, also coding these individuals as 1 along with those who asked and received all or some of their request. These two alternative operationalizations measured willingness to negotiate, but not success in negotiation at the level of the "Negotiation ability" variable. The two lesser measures of negotiation did not have effects on salary, and thus were abandoned in favor of the negotiation variable measuring receipt of full request.

In contrast to networks and negotiation ability aiding salary, *"stop-the-clock" policies* might restrict salary given delayed promotion and have been found to have gendered effects (National Research Council, 2010). The analysis includes a dummy variable coded 1 for those who "Extended tenure clock." Additionally, the dissertation will test models including and excluding *academic rank,* given findings on discrimination within the promotion process (Barbezat & Hughes, 2005; Hearn, 1999; National Academy of Sciences - National Research Council, 2001).

3.3.3.4 Discipline

Salaries vary across *disciplines*, and are therefore also included in the model as control variables (American Association of University Professors, 2011; Bellas, 1997; Umbach, 2007). The four disciplines are biology, biochemistry, civil engineering, and mathematics, where civil engineering commands higher median salaries than the other three disciplines (National Science Foundation, 2015a). Civil engineering serves as the reference discipline.

3.3.3.5 Additional Departmental and Institutional Factors

Certain departmental and institutional characteristics are also known to matter for salary. *Department size* measures the number of faculty members in the respondent's department and was drawn from the population file created by the NETWISE II Survey administrators. It is a count of the number of individuals in the department. Finally, based on salary variation related to *institutional research intensity* (Barbezat & Hughes, 2005; Lee & Won, 2014; National Academy of Sciences - National Research Council, 2001; Tolbert, 1986; Toutkoushian, 1998b), the analysis includes dummy variables for the Carnegie classification of institutions: Research Extensive, Research Intensive, Masters, and Liberal Arts. HSI designation is not among the control variables, but instead those institutions are grouped within their Carnegie-classification of research intensity.

Table 3.5 **Control Variables**

Variable	Operationalization
Personal Characteristics	
Marital status	[0,1] Three dummy variables coded 1 for each relationship status: Single; Divorced, widowed or separated; Married or living in a marriage-like relationship.
Parental status	[0,1] Dummy variable coded 1 for yes responses to “Since you have been a faculty member at your institution, have you cared for dependent children?” and coded 0 otherwise.
Foreign-born	[0,1] Dummy variable coded 1 for foreign-born and coded 0 native-born U.S. citizen.
Human Capital	
Years since PhD	[C] Number of years since receipt of PhD
Postdoctoral appointment	[0,1] Dummy variable coded 1 for postdoctoral appointment and coded 0 otherwise.
Worked in government	[0,1] Dummy variable coded 1 for yes response to question: “Have you ever worked full time for a government agency?” Coded 0 otherwise.
Worked in private industry	[0,1] Dummy variable coded 1 for yes response to question: “Have you ever worked full time for private industry?” Coded 0 otherwise.
Worked in nonprofit organization	[0,1] Dummy variable coded 1 for yes response to question: “Have you ever worked full time for a non-profit organization (non-academic)?” Coded 0 otherwise.
Career Advancement	
Mobility	[C] Interval variable to the question: “At how many universities have you had a position as a tenure track or tenured faculty member?”
12 month contract	[0,1] Dummy variable coded 1 for 12 month contract and coded 0 otherwise.
Journal articles	[C] Interval variable to the question: “During the past two academic years, how many of the following have you produced? Peer reviewed journal articles”
Grant funds awarded	[C] Interval variable to question: “What is the total dollar amount of those successful grants?” The question regards external research grants.
Percent of time teaching	[C] Interval variable to question: “What percentage of your work hours are allocated to these activities? Teaching.”
Average weekly hours worked	[C] Interval variable to question: “On average, how many hours do you work in a typical week?”
Network ties	[C] Interval variable measuring total number of network ties.
Negotiation ability	[0,1] Dummy variable coded 1 for “Negotiated for more money or resources, and received ALL of it” response to the question “Describe what happened when you were given the salary offer for your first academic position.” Coded 0 otherwise.
Current or past chair/dean	[0,1] Dummy variable coded 1 for respondents who currently hold or ever held the position of department chair, department head, or dean of a school or college and coded 0 otherwise.
Chaired professorship	[0,1] Dummy variable coded 1 for respondents who are currently in a chaired professorship and coded 0 otherwise.
Research director	[0,1] Dummy variable coded 1 for respondents who currently hold the position of Director of a Research Center or Institute and coded 0 otherwise.
Extended tenure clock	[0,1] Dummy variable coded 1 for respondents who answered yes to the question: “Since you have been a faculty member at your institution, have you extended or reset your tenure clock?”
Rank	[0,1] Three dummy variables for: Assistant, Associate, Full
Department	
Discipline	[0,1] Four dummy variables coded 1 for each discipline: biology, biochemistry, civil engineering, mathematics.
Department size	[C] Interval variable measuring number of faculty in the department
Institution	
Institutional Type	[0,1] Four dummy variables for Carnegie classification: Research Extensive, Research Intensive, Masters, Liberal Arts

3.4 Weighted Descriptive Statistics on Gender, Race, and Salary

To understand the NETWISE II Survey data in light of prior literature and data, the following discussion presents a comparison of weighted means of the control variables by gender and race. Table 3.6 displays descriptive statistics for all variables for the full sample, and tables displaying descriptive statistics by gender, by race, and for the subsample of faculty in research institutions can be found in Appendix Tables A.1-A.3.

Table 3.6 **Descriptive Statistics for Full Sample, Weighted**

	Mean	SD	Minimum	Maximum
Dependent variable				
Salary	$92,347	$34,355	$27,000	$300,000
Independent variables				
Female	29%	46%	0	1
Underrepresented minority (URM)	8%	28%	0	1
HBCU or women's college	5%	22%	0	1
Private	32%	47%	0	1
Revenue per FTE	$42,621	$36,683	$10,702	$277,888
Percent of revenue from public sources	42%	24%	0.48	91.09
Control variables: Personal characteristics				
Married or living in a marriage-like relationship	87%	34%	0	1
Divorced, separated, widowed	6%	24%	0	1
Single	7%	25%	0	1
Cared for children	54%	50%	0	1
Foreign-born	29%	45%	0	1
Control variables: Human capital				
Years since PhD	21.18	11.23	1	52
Years since PhD squared	574.4	547.38	1	2,704
Postdoctoral apt	66%	47%	0	1
Worked in government	17%	38%	0	1
Worked in private industry	21%	41%	0	1
Worked in nonprofit organization	5%	23%	0	1
Control variables: Career advancement				
Mobility	1.36	0.87	0	30
12 month contract	14%	35%	0	1
Journal articles	5.04	7.62	0	150
Grant funds awarded (‘000s)	$477	$1,439	0	$30,150
Percent of time on teaching	42%	22%	0	100
Average weekly hours worked	54.29	11.27	5	100
Network ties	9.51	3.95	1	26

Table 3.6 (continued)

Negotiation ability	9%	29%	0	1
Current or past chair/dean	25%	43%	0	1
Chaired professorship	8%	27%	0	1
Research director	7%	25%	0	1
Assistant	21%	41%	0	1
Associate	32%	47%	0	1
Full	47%	50%	0	1
Extended tenure clock	10%	29%	0	1
Control variables: Department				
Civil Engineering	18%	39%	0	1
Biology	43%	49%	0	1
Biochemistry	13%	33%	0	1
Math	26%	44%	0	1
Department size	26.11	19	1	139
Control variables: Institutional/Carnegie				
Research Extensive	52%	50%	0	1
Research Intensive	18%	38%	0	1
Liberal Arts	10%	29%	0	1
Masters	21%	41%	0	1
Observations	2352			

Women in both the full sample and subsample have characteristics that are typically associated with lower pay (Appendix A.2). Women have fewer years since PhD, are less likely to be full professors, are less mobile, produce fewer journal articles (full sample only), spend more time on teaching, work in high female fields, and are less likely to hold administrative and chaired positions. These gendered differences among STEM faculty are in keeping with NSF data on STEM faculty and the higher education literature of overall faculty (National Research Council, 2010; Nettles, et al., 2000).Women are more likely than men to have cared for children during their time as faculty and to have stopped the tenure clock. Contrary to expectations, women in the full sample successfully negotiated their first job offer more often than men. Additionally, more women had held postdoctoral appointments, while more men had worked in private industry. While these descriptive statistics give a sense of gender differences in important characteristics, it should be noted that several of the characteristics are tied to age. Women are younger; thus, it is not surprising that they are, for example, less mobile as measured by number of positions and are less likely to have held or hold administrative positions.

Whereas men and women differ significantly on most variables, racial groups do not. Underrepresented minority faculty do not differ significantly from white and Asian faculty on marital status, parental status, postdoctoral appointment, work in private industry, mobility, time spent on teaching, negotiation ability, use of stop-the-clock policies, field, or institutional types—whereas male and female faculty differ significantly on all of those characteristics (Appendix A.3). URM faculty do have less experience overall, less administrative experience, and lower rank than white and Asian faculty, similar to prior findings (National Science Foundation, 2015a, 2015b). URM faculty in the full sample published fewer journal articles on average in the last two years than white and Asian faculty, but were on par in publications in the subsample of research institution faculty. Almost half of URM faculty are foreign-born.

Both women and URM faculty have lower mean salaries than male and white and Asian faculty. On average, faculty in the full sample earn about $92,000 in salary. Not surprisingly, average salary (about $102,000) is higher among faculty in the subsample given they are all located in research universities (Appendix A.1). These salary levels are consistent with NSF data, which show *median* salaries of $66,000 to $82,000 for assistant professors and $104,000 to $132,000 for full professors in biology, math, and engineering (National Science Foundation, 2015a, Table 59). Women earn $14,800 less, on average, than male STEM faculty in the full sample and $19,300 less in the subsample of research institution faculty. URM faculty earn $11,400 less than white and Asian faculty in the full sample and $15,000 less in the subsample.

Among the control variables, salary shares the strongest bivariate relationships with years since PhD, rank, percent of time teaching, administrative responsibilities, and research extensive institutions. Only one correlation coefficient raises concerns over multicollinearity—the coefficient for *Private* and *Percent of Revenue from Public Sources*. Given the strength of that relationship (-0.81), the regression analysis in Chapter 4 runs separate models for public and private institutions when testing the influence of public funds on salary equity (H2b). None of the other variables demonstrate a correlation of 0.80 or above, the typical measure for multicollinearity (Kennedy, 2008, p. 196).

3.5 Data Analysis Methods

This dissertation uses OLS regression with interaction terms to test the hypotheses of institutional influence on gender and racial pay gaps. The next chapter begins with OLS regression models based on traditional explanations of pay disparity—human capital, marital and parental status, negotiation ability, social capital, and discipline. Then, the analysis turns to the hypothesized relationships between institutional factors and pay gaps by gender and race.

Common statistical techniques in national faculty salary studies are single equation OLS regression and multiple equation regression analyses that segregate models by gender (Perna, 2003; Toutkoushian & Hoffman, 2002). Scholars have used causal modeling and hierarchical linear modeling (HLM) in only a few cases (reviewed in Perna, 2003), in spite of its potential benefits, given the combination of individual and institution-level characteristics in these studies. Loeb (2003) provides a comparison of OLS and HLM, finding similar results from the two procedures. In reviewing single, two, and three equation analyses, Toutkoushian and Hoffman (2002) recommend the use of multiple methods where possible to understand the influence of methodology on results. They note, however, that for groups of small size, such as minority groups among faculty, single equation models may be the only option.

Interaction terms are appropriate to this analysis given the conditional or contextual nature of the hypotheses (Brambor, Clark, & Golder, 2006). The hypotheses state that salary gaps between women and men and between racial groups depend on the institutional context. Thus, the interaction of institutional factors with gender and race allows the effects of gender and race on salary to vary across institutional settings. The models testing hypotheses interact the key institutional variables with gender, race, and all control variables. Interaction terms and all constitutive terms—those variables used to create the interaction term (Brambor, et al., 2006)—are included in the models. Thus, there are five primary models based on the key institutional variables: 1) HBCU/Women's, 2) Private, 3) Revenue per FTE, 4) Percent public revenue, and 5) Department head discretion. Each of the five models follows the equation below. A preliminary model in Chapter 4 will test whether the control variables listed in Table 3.5 should be included in all models. All models testing hypotheses will then include the same control variables, unless otherwise noted. Rank, marital status, and parental status, in particular, will only be included as controls in separate models in the Appendix given controversy over their legitimacy.

$$Salary = \beta_0 + \beta_1 Female + \beta_2 URM + \beta_3 Institutional\ Factor + \beta_4 Female*Institutional\ Factor + \beta_5 URM*Institutional\ Factor + \beta_j\ Control\ Variables + \beta_k\ Control\ Variables*Institutional\ Factor$$

For all models, the coefficients of interest are β_4 and β_5. (i.e. the interaction between gender and the key institutional variable and between race and the key institutional variable). The key institutional variables HBCU/Women's and Private are dummy variables. The models focused on these independent variables display the factors influencing salary for each type (HBCU/Women's vs. other institutions, Private vs. Public), as well as the interaction terms, which is the difference in returns to each characteristic between the two institutional categories. The other three independent variables—Revenue per FTE, Percent of public revenue, and Department head discretion—are continuous variables. For those three models, the analysis displays just the interaction terms between the independent variables and gender and race. (Full models are available in the Appendix.) The constitutive terms are not displayed in the text as they are meaningless, given that holding other terms to zero is not realistic. Instead, the analysis shows graphically how these institutional factors influence pay gaps. Additional models follow the same pattern as these five primary models but with disaggregated race/ethnicity dummy variables in place of the URM variable.

CHAPTER 4: RESULTS

4.1 Introduction

This dissertation tests three major hypotheses. First, public universities and those with institutional missions to serve underrepresented populations will pay women and underrepresented minority (URM) STEM faculty more similarly to white and Asian men than do private universities and those without that mission. Second, wealthier institutions and those less reliant on public funds will have a larger pay gap between women and men and between URM and non-URM faculty. Finally, institutions that give department chairs more autonomy to decide salary and incentive offers will have larger pay gaps between white and Asian men and comparable women and URM STEM faculty.

These hypotheses argue that organizational setting influences pay equity, whereas traditional explanations focus on individual factors (primarily human capital, but also marital and parental status, social capital, and negotiation ability) and disciplinary differences. The chapter begins with an examination of the influence of human capital and disciplinary traits on faculty pay gaps by gender and race. The chapter then proceeds to the institutional-level analysis, first exploring descriptively how faculty characteristics vary across institutional groups and then testing models on the influence of institutional mission, organizational resources, and discretionary power on gender and racial pay gaps among STEM faculty.[17] Finally, the chapter concludes with a summary of findings.

4.2 The Traditional Model: Human Capital and Discipline

The leading explanations for pay gaps among faculty are human capital and disciplinary differences. Regression results confirm that these traits influence salary among STEM

[17] Given the number of control variables and size of the models, full models testing each hypothesis are in the appendices and condensed models are provided in this chapter.

faculty, with greater experience, mobility, administrative experience, grant-getting ability, and department size increasing pay (Table 4.1).[18] Further, more time spent on teaching and extension of the tenure clock decrease salary. Civil engineering provides higher salaries, confirming structural theories of male-dominated fields out-earning female-dominated fields. The one unexpectedly absent effect is from publications. An increase in journal articles over the two-year period does not significantly influence salary. Prior literature has examined career publications (see for example, Porter, et al., 2008; Toutkoushian, 1998b), which perhaps captures the variation in returns to productivity better than this near-term productivity of two year publication record.

If these human capital and disciplinary traits vary systematically by race or gender, then they can explain a portion of the salary gaps among women and men and URM faculty and white and Asian faculty. As discussed in Chapter 3, the survey respondents here exhibit significant differences in human capital and disciplinary traits—with women and URM faculty holding traits often associated with lower pay (see Appendix A.2 and A.3). Table 4.1 provides regression results for the pay gap among STEM faculty with progressive controls for experience, departmental characteristics, and career advancement traits. These traits fully explain the salary gap between men and women and among racial groups, until institutional variables are included.

In simple models of race and gender, male faculty earn $15,000 more than female faculty of the same minority status (Table 4.1). White and Asian faculty earn $10,300

[18] Five control variables do not significantly influence salary or improve the models. These variables are years since PhD squared, full-time employment in government, full-time employment in nonprofit organization, full-time employment in private industry, and average number of hours worked weekly. After testing these variables, they were excluded from all further models. All further models include the same control variables as Table 4.1, unless otherwise noted. (Higher rank increases salary, as expected, with effects on salary greater than most other characteristics (Appendix A.5). Since gender and race are not significant in Table 4.1, rank does not change the interpretation of the gender and racial salary gaps.)

more than underrepresented minority faculty of the same gender. Years of experience and field account for a large portion of that gap, however. Controlling for years since PhD and STEM field removes the significance of the gender pay gap and lowers the racial pay gap to $4,700. Years of experience, in particular, dramatically alters the results—explaining $11,000 of the total $15,000 salary gap between men and women and almost half of the racial salary gap.[19] Finally, the addition of career advancement traits removes the significance of the racial pay gap (Model 3 in Table 4.1). The one exception in pay equity based on individual and departmental characteristics is foreign-born faculty, who earn $4,300 less than native-born faculty based on career advancement traits.Table 4.1 would lead to the conclusion that male and female STEM faculty are on par in pay once experience and field are taken into account. Likewise, URM faculty are in line with white and Asian faculty who do similar work. The results seem to confirm human capital and structural theories that experience, productivity, and gendered fields fully explain the pay gaps among STEM faculty. However, the inclusion of institutional variables (Model 5) calls into question the ability of human capital and structural theory to explain the conditions of STEM faculty adequately. When controlling for institutional research intensity, private status, HBCU/Women's college status, revenue, and reliance on public revenue, the racial pay gap becomes significant again. Models, not shown here, adding the institutional variables separately shows that Carnegie-classification of research intensity and revenue per FTE student cause the racial pay gap to become significant.[20]

[19] A separate model, not shown here, tested the influence of years of experience and field on salary separately.

[20] The model included all of the controls in Model 4 of Table 4.1. Another series of simpler models regressed each institutional variable on salary, along with gender, race, and foreign-born status. Thus, none of the disciplinary or human capital traits were included. In these simpler models, research intensity explained $400 of the gender salary gap and $650 of the racial salary gap. HBCU/Women's college setting explained $300 of the gender salary gap and $1,700 of the racial salary gap. Reliance on public revenue

In addition to the human capital explanations of salary disparities, other prominent individual-level explanations, reviewed in Chapter 2, are marriage and parental status, network ties, and negotiation skills. As shown in Table 4.1, a larger network has positive impacts on salary; however, these effects do not vary significantly by gender or race (see Appendix A.6 and A.7). In contrast, negotiation ability, marital status, and parental status do not show significant influence on faculty salary (Table 4.1 and Appendix A.6) and do not show gendered or racial differences in their effects (Appendix A.6 and A.7). These results do not suggest support for these alternative individual-level explanations for pay gaps among faculty.

explained $650 of the gender salary gap. Private/public status did not alter the salary gaps substantially. Finally, revenue per FTE worked in the opposite direction of other institutional variables. Controlling for revenue increases the gender salary gap by $600 and the racial salary gap by $1,700. Women and minority faculty work in institutions with higher resources on average (Table A.1), thus those higher resources aid women and minority faculty salaries in total. These results are notable in that they explain a portion of the salary gaps according to where women and minorities work; however, they do not speak to the central question of this dissertation. The central argument of this dissertation is not how institutional variables explain the overall salary gaps, but rather how salary gaps and rewards vary across organizational settings.

Table 4.1 **Influence of Individual, Departmental, and Institutional Characteristics on STEM Faculty Salary**

VARIABLES	(Model 1) Demographics	(Model 2) Plus Experience & Field	(Model 3) Plus Other Human Capital & Career Advancement	(Model 4) Plus Departmental	(Model 5) Plus Institutional
Female	-15,008***	-2,119	44.1	-36.6	-1,021
	(-7.74)	(-1.43)	(0.037)	(-0.031)	(-0.88)
Underrepresented minority	-10,348***	-4,716**	-2,772	-2,627	-3,725**
	(-4.97)	(-2.21)	(-1.60)	(-1.44)	(-2.03)
Foreign-born	-3,354	1,248	-4,082**	-4,295**	-3,539**
	(-1.24)	(0.56)	(-2.21)	(-2.33)	(-2.00)
Years since PhD		1,779***	1,187***	1,153***	1,187***
		(15.8)	(11.6)	(11.4)	(12.1)
Postdoctoral appointment			4,782**	4,782**	2,806
			(2.38)	(2.37)	(1.38)
Mobility			2,632***	2,593***	2,919***
			(2.80)	(2.75)	(3.01)
12 month contract			8,745***	9,118***	8,827***
			(3.07)	(3.24)	(3.20)
Journal articles			199	198	191
			(1.01)	(1.02)	(1.11)
Grant funds awarded ('000s)			1.90**	1.70*	1.87**
			(2.00)	(1.86)	(2.08)
Percent of time on teaching			-386***	-364***	-339***
			(-7.44)	(-6.80)	(-5.84)
Network ties			530***	506**	377*
			(2.58)	(2.43)	(1.77)
Negotiation ability			4,851	5,026*	5,576*
			(1.64)	(1.69)	(1.83)
Extended tenure clock			-3,718**	-3,708**	-4,309***
			(-2.43)	(-2.42)	(-2.97)

Table 4.1 (continued)

Current or past chair/dean			10,266***	11,434***	9,898***
			(3.83)	(4.10)	(3.50)
Chaired professorship			25,608***	25,867***	23,525***
			(5.89)	(5.97)	(5.53)
Research director			10,106***	10,378***	9,811***
			(2.79)	(2.84)	(2.82)
Biology		-19,030***	-18,847***	-18,600***	-16,467***
		(-7.14)	(-8.44)	(-8.27)	(-6.89)
Biochemistry		-9,718***	-11,559***	-10,726***	-9,851***
		(-3.23)	(-4.46)	(-4.16)	(-3.70)
Math		-19,745***	-12,220***	-12,121***	-12,037***
		(-7.72)	(-5.50)	(-5.47)	(-5.22)
Department size				118**	113**
				(2.33)	(2.00)
Research Intensive					-4,237*
					(-1.94)
Liberal Arts					2,712
					(0.94)
Masters					-931
					(-0.41)
Private					-112
					(-0.032)
HBCU or Women's College					-895
					(-0.51)
Revenue per FTE					0.15***
					(3.74)
Percent of revenue from public funds					-80.1
					(-1.18)
Constant	98,573***	69,845***	77,249***	73,821***	71,889***
	(51.1)	(25.6)	(18.6)	(16.5)	(12.5)
Observations	2,352	2,352	2,352	2,352	2,352
R-squared	0.048	0.387	0.590	0.594	0.623

Robust t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

4.3 The Institution

4.3.1 Descriptive Statistics

The traditional models controlling for human capital, career advancement, and discipline suggest that the gender and racial pay gaps among STEM faculty are insignificant. However, the central claim of this dissertation is that organizational setting matters to faculty conditions, and such variations among organizations are not adequately captured in the traditional models. Some descriptive examples of the varied characteristics across institutional categories support that claim. For example, 39 percent of women in HBCU and women's colleges (weighted full sample) have served or currently serve as department chairs or deans. That level of administrative experience is comparable to men's experience in HBCUs and women's colleges (34%) and far beyond the administrative experience of men and women in other institutions (27% and 16%, respectively). The same holds true for URM faculty, who are on par with white and Asian faculty in administrative experience in HBCU/Women's colleges but fall well below their levels in other institutions. Further, women and URM faculty in HBCU/Women's colleges have similar years of experience to men and white and Asian faculty—a key determinant of pay and a major contributor to salary disparities among faculty in other institutions. Women in the sample who work in public institutions produce more journal articles, are more likely to be civil engineers, and less likely to be assistant professors than women in private institutions. These are just a few examples of the variation in traits across institutional groups, but they demonstrate that key determinants of pay are not necessarily consistent across institutional categories.

Human capital and career advancement traits vary across institutional groups, but does the salary treatment of faculty vary? Table 4.2 provides mean salaries by institutional type.[21] Faculty in HBCU/Women's colleges earn less than faculty in other institutions, but do not have significant mean salary gaps by gender or race—suggesting support for Hypothesis 1a. URM faculty in private institutions with above average public resources show a significant difference in mean salary with white and Asian faculty, suggesting a lack of support for Hypothesis 2b, which states that public resources will diminish salary gaps. Additionally, Masters and Liberal Arts institutions do not have significant racial pay gaps at the mean. All other institutional groupings, however, demonstrate significant gender and racial pay gaps at the mean. The remainder of this chapter tests whether these gender and racial gaps remain once human capital and disciplinary differences are taken into account.

[21] Three of the hypothesized institutional influences—organizational resources, composition of resources, and discretionary authority—are continuous variables. For descriptive comparison purposes, Table 4.2 shows mean salaries for faculty by dividing them into institutions with above and below average levels of resources, public resources, and department head discretion. Additionally, it should be noted that the sampling framework for the NETWISE II Survey was prestigious liberal arts institutions. Prior literature typically finds higher salaries associated with research intensity; however, the Liberal Arts institutions here demonstrate higher overall mean salaries than research intensive and masters institutions.

Table 4.2 **Weighted Mean Salary by Institutional Category (in thousands)**

	N	Overall Mean Salary	Male	Female		White/Asian	URM	
Mission								
HBCU/Women's	*267*	$ 77	$ 76	$ 79		$ 78	$ 76	
Non-HBCU/Women's	*2085*	93	98	82	***	94	83	***
Private	*976*	93	98	83	***	94	83	***
Public	*1376*	92	96	81	***	93	82	***
Resources								
Above average revenue per FTE	*429*	107	113	95	***	110	88	***
Below average revenue per FTE	*1923*	87	91	77	***	88	79	***
Above average public revenue (Private)	*198*	105	112	90	***	109	85	***
Below average public revenue (Private)	*778*	86	89	80	***	87	80	
Above average public revenue (Public)	*647*	98	102	85	***	99	84	***
Below average public revenue (Public)	*729*	86	90	78	***	87	79	**
Power								
Above average discretion	*352*	101	106	85	***	102	89	***
Below average discretion	*384*	102	108	90	***	104	87	***
Research Intensity (Carnegie-classification)								
Research Extensive	*698*	103	108	88	***	104	89	***
Research Intensive	*498*	83	87	76	***	84	71	***
Masters	*656*	76	77	72	***	76	74	
Liberal Arts	*500*	89	92	84	***	89	82	

*** p<0.01, ** p<0.05, * p<0.1

4.3.2 Research Intensity

When observing institutional differences, prior research typically focuses on the Carnegie-classification institutional type based on research intensity. Pfeffer and Ross (1990) argued that the research focus of research institutions brings complexity to evaluation, thus heightening the possibility of discrimination. Several studies find larger gender pay gaps at research institutions, while the racial pay gap is insignificant across institutional types (Barbezat & Hughes, 2005; Lee & Won, 2014; National Academy of Sciences - National Research Council, 2001; Tolbert, 1986; Toutkoushian, 1998b). Results here do not support those prior findings, as the gender salary gap is insignificant across all Carnegie-classification institutional types (Table 4.3). The coefficients point to negative relationships between women and pay at research institutions, but do not reach significance. Likewise, URM faculty do not show significant pay gaps among comparable white and Asian faculty across institutional types, except in research intensive institutions. Within these institutions, results show a $12,200 pay gap between URM faculty and white and Asian faculty. Further disaggregation by race reveals that faculty in the “other race” category drive that pay gap at research intensive institutions, while African American and Hispanic faculty have pay gaps with white faculty barely surpassing the 0.1 significance level.

Thus, similar to human capital and disciplinary explanations, research intensity classifications seem to suggest that gender pay gaps are not significant among STEM faculty in any institutional type, while racial gaps are only significant in the research intensive settings. Again, the argument of this dissertation is that traditional models—including the Carnegie-classification institutional type—do not fully account for the organizational influences on pay gaps among STEM faculty. There are other categorizations of institutions that may lend insight into how women and underrepresented minorities are faring comparatively.

Table 4.3 **Salary Gaps by Carnegie-Classification Institutional Type (Abbreviated Model)**

VARIABLES	(1) Research Extensive	(2) Research Intensive	(3) Masters	(4) Liberal Arts
Female	-1,688	-1,099	901	91
	(-0.76)	(-0.56)	(0.68)	(0.045)
Underrepresented minority	-3,321	-12,189***	859	4,449
	(-1.12)	(-3.57)	(0.54)	(0.94)
Foreign-born	-5,235**	-2,563	-2,894*	-1,062
	(-1.98)	(-1.07)	(-1.70)	(-0.40)
Observations	698	498	656	500
R-squared	0.647	0.485	0.548	0.582

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Same control variables as Model 4 in Table 4.1 plus private status. The Liberal Arts model does not control for private status since they are private. Full model in Appendix A.8.

4.3.3 The Influence of Institutional Identity

In the U.S. postsecondary system, certain institutions have missions that focus on populations formerly excluded from higher education. In particular, women's colleges and HBCUs were established to provide access to underrepresented groups and continue with that mission today. Hypothesis 1a stated that institutions whose mission focuses on underrepresented populations (i.e., women and minorities) will have a smaller pay gap given their historical focus on inclusion. The results here show that female faculty working in HBCU and women's colleges earn $5,800 more, on average, than comparable male faculty.[22] In institutions that are not mission-driven toward underrepresented populations, the gender pay gap is not significant. As noted in Chapter 3, the coefficient of most interest is the interaction of gender or race with the institutional variable. Here, the interaction term ($6,420) demonstrates that there is a statistically significant difference in the gender salary gap between institutions with and without a mission focused on underrepresented groups.

The intent of the hypothesis is important here. HBCU/Women's colleges have a larger gender pay gap than other institutions, disconfirming the hypothesis that pay gaps would be smaller in these institutions. However, the HBCU/Women's colleges gender pay gap is in the opposite direction of prior literature on gender pay gaps among faculty. Women earn more than comparable men in these institutions—a result contrary to previous findings on faculty. Thus, while the gender pay gap is larger in HBCU/Women's colleges, that gap is in the direction that conforms to the expectations of these institutions differing from other institutions in their attention to underrepresented populations.

It is hard to know why women earn more than comparable men at HBCU/Women's colleges—in part because the reward structure appears so similar to other institutions. Years of experience may matter less to salary at HBCU/Women's colleges, but only at the 0.1 significance level. The returns to salary from other human capital, career advancement characteristics, and discipline do not show a significant

[22] There is some question of whether both institutional types—women's colleges and HBCUs—would exhibit this favorable treatment toward women, or whether only women's colleges would, given their mission of access to women. Separating women's colleges and HBCUs suggests that combining the institutional types is acceptable. In each institutional type, the gender pay gap is not significant given smaller sample sizes; however, the female coefficient in both institutional types is positive and greater than $2,000.

difference across the two institutional types. Table 4.5 shows the progressive influence of control variables at HBCU/Women's colleges. Women and men have similar salaries prior to controls, then women have the advantage in even simple models of experience and field.

Turning to race, the results show that URM faculty do not earn significantly different salaries than comparable white and Asian faculty in either institutional setting. The interaction term ($2,425) fails to reach significance, and it is not possible to conclude whether minority faculty fare better or worse comparatively in HBCU/Women's colleges or other institutions. Foreign-born faculty earn almost $3,800 less than comparable native-born faculty in the "other institutions" category and a statistically insignificant $900 more in HBCU/Women's colleges, but the interaction term again falls short of statistical significance.

Table 4.4 **Influence of Institutional Mission on STEM Faculty Salary**

VARIABLES	(Model 1) HBCU/Women's	(Model 2) Other	Difference
Female	5,765**	-655	6,420**
	(2.01)	(-0.53)	(2.06)
Underrepresented minority	-832	-3,258	2,425
	(-0.28)	(-1.60)	(0.68)
Foreign-born	891	-3,788**	4,679
	(0.33)	(-2.03)	(1.42)
Years since PhD	829***	1,160***	-331*
	(5.76)	(11.1)	(-1.86)
Postdoctoral appointment	2,647	3,686*	-1,039
	(0.98)	(1.68)	(-0.30)
Mobility	2,963	2,784***	178
	(1.25)	(2.78)	(0.069)
12 month contract	20,776**	8,379***	12,397
	(2.07)	(2.90)	(1.19)
Journal articles	158	226	-67.5
	(0.85)	(1.14)	(-0.25)
Grant funds awarded ('000s)	-1.84	1.83**	-3.67
	(-0.80)	(2.02)	(-1.49)
Percent of time on teaching	-358***	-351***	-7.64
	(-3.92)	(-5.77)	(-0.070)
Network ties	340	434**	-93.1
	(0.87)	(1.98)	(-0.21)
Negotiation ability	13,998	4,408	9,591
	(1.56)	(1.45)	(1.01)
Extended tenure clock	334	-4,616***	4,951
	(0.096)	(-2.96)	(1.30)
Current or past chair/dean	7,946***	11,101***	-3,155
	(2.70)	(3.76)	(-0.76)
Chaired professorship	25,031***	24,319***	712
	(2.74)	(5.37)	(0.070)
Research director	3,096	10,440***	-7,344
	(0.49)	(2.81)	(-1.00)
Biology	-10,444***	-17,758***	7,314
	(-2.68)	(-7.12)	(1.58)
Biochemistry	-12,127**	-10,708***	-1,419
	(-2.41)	(-3.82)	(-0.25)
Math	-9,947***	-12,100***	2,153
	(-2.72)	(-4.99)	(0.49)
Department size	335*	109*	225
	(1.66)	(1.86)	(1.07)
Research Intensive	2,686	-7,584***	10,270
	(0.36)	(-3.48)	(1.34)

Table 4.4 (continued)

Liberal Arts	17,756**	-1,913	19,669**
	(2.34)	(-0.64)	(2.41)
Masters	4,501	-4,900**	9,400
	(0.62)	(-2.11)	(1.24)
Private	-1,350	6,832***	-8,182**
	(-0.42)	(2.90)	(-2.04)
Constant	61,033***	74,898***	74,898***
	(5.85)	(15.0)	(15.0)
Observations	267	2,085	2,352
R-squared	0.527	0.611	0.612

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.5 **Salary Determinants in HBCU/Women's Colleges**

VARIABLES	(1) Demographics	(2) Plus Experience & Field	(3) Plus Other Human Capital & Career Advancement	(4) Plus Departmental	(5) Plus Institutional
Female	2,160	6,217*	5,722*	5,737**	5,765**
	(0.55)	(1.72)	(1.93)	(1.99)	(2.01)
Underrepresented minority	-1,729	-1,101	-2,978	-3,005	-832
	(-0.40)	(-0.30)	(-1.16)	(-1.14)	(-0.28)
Foreign-born	-4,335	-47.7	-96.6	-123	891
	(-1.24)	(-0.016)	(-0.034)	(-0.044)	(0.33)
Observations	267	267	267	267	267
R-squared	0.009	0.272	0.503	0.503	0.527

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Same controls as Table 4.4. Full table available in Appendix A.10.

Public institutions should have smaller gender and racial pay gaps than private institutions given their identity of access and accountability (Goodsell, 2015; Mandel & Semyonov, 2014; Morphew & Hartley, 2006; Tolbert, 1986). Results show that female faculty in private institutions earn about $3,100 less than comparable male faculty in STEM disciplines (Table 4.6). In contrast, there is no discernible gender pay gap in public institutions. While these results seem to confirm expectations, the interaction of gender and private status does not show a significant difference in the gender pay gap between public and private institutions.

Likewise, public and private institutions are not significantly different in their racial pay gaps with aggregate or disaggregate race/ethnicity. It is noteworthy, however, that while not significant, the coefficient for URM status in public institutions is negative. The variation in racial pay gaps across public and private institutions cannot be confirmed; however, the results suggest that public institutions are not exhibiting the salary equity expected for minority faculty. Foreign-born faculty are not experiencing a more equitable environment in public institutions, either. Foreign-born faculty earn $5,700 less than comparable native-born faculty in public institutions, while the pay gap is not significant at private institutions and in the positive direction.

Table 4.6 **Influence of Public/Private Status on STEM Faculty Salary (Abbreviated Model)**

VARIABLES	(1) Private	(2) Public	Difference
Female	-3,131*	562	-3,693
	(-1.68)	(0.36)	(-1.53)
Underrepresented minority	-4,374	-2,606	-1,768
	(-1.41)	(-1.22)	(-0.47)
Foreign-born	1,136	-5,702***	6,838*
	(0.41)	(-2.65)	(1.95)
Observations	976	1,376	2,352
R-squared	0.586	0.648	0.628

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Same controls as Table 4.4. Private status does not act as a control in Table 4.6, but is used as the subpopulation institutional grouping here. Full table available in Appendix A.11.

4.3.4 The Role of Organizational Resources on Pay Gaps

While some institutions may have an identity of access and inclusion, other institutions may stand apart in their competition to attract and retain faculty. Organizational resources influence the ability of institutions to compete for faculty, and certain institutions—regardless of Carnegie-classification institutional type—are better poised to compete based on their resources (Ehrenberg, 2011). Hypothesis 2a posits that organizational resources offer another categorization of institutions that might affect pay equity among women and underrepresented minorities. The results show an increasing gender pay gap associated with greater revenue per full-time equivalent student. In fact, the interaction of revenue and gender is the most significant interaction among the hypothesized gender relationships in this dissertation, reaching the significance level of 0.01. Based on the results in Table 4.7, URM faculty do not appear to have the same salary disadvantage connected with revenues as women do. However, further disaggregation of race provides more complex results. Table 4.8 shows that the pay gap between African American and white faculty and between Hispanic and white faculty grows with increasing revenues per student.

Since the models interact institutional resources with all variables, the interpretation of Tables 4.7 and 4.8 is somewhat difficult given that no schools have zero resources or several other characteristics at zero. Figures 4.1 and 4.2 provide a visual depiction of the rising pay gaps related to revenue, holding all variables to their means and observing the role of institutional resources up to $200,000 per FTE. The graphs display 95% confidence intervals around the estimated pay gap. The gender pay gap becomes significant between $40,000 and $45,000 per FTE (0.05 significance level), while the African American and white pay gap becomes significant at $55,000 per FTE (0.05 significance level). Few institutions have such resources. Ninety percent of faculty in the weighted survey work in institutions with less than $55,000 in revenues per FTE. Thus, the pay disparities identified in Tables 4.7 and 4.8 are significant in only the most well-resourced institutions.

Table 4.7 **Influence of Institutional Resources on STEM Faculty Salary (Abbreviated Model)**

VARIABLES	
Revenue per FTE*Female	-0.12***
	(-2.63)
Revenue per FTE*URM	-0.073
	(-1.46)
Revenue per FTE*Foreign-born	0.051
	(1.08)
Observations	2,352
R-squared	0.657

Robust t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Note: Same controls as Table 4.4. Full table available in Appendix A.12.

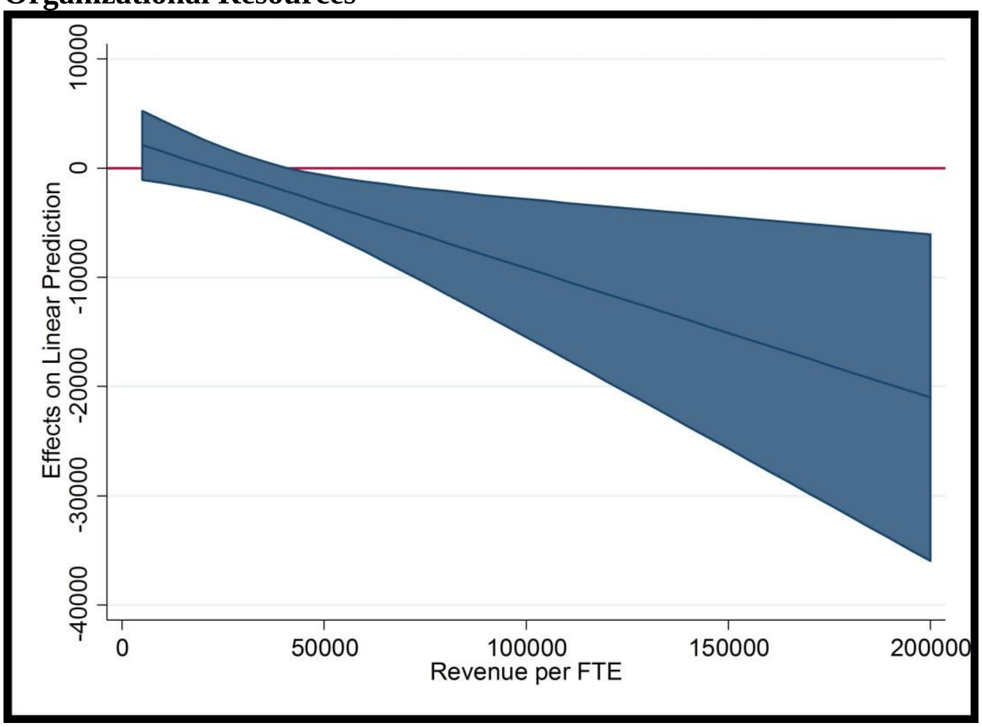
Table 4.8 **Influence of Institutional Resources, Disaggregated by Race/Ethnicity**

VARIABLES	
Revenue per FTE*Female	-0.12***
	(-2.63)
Revenue per FTE*Asian	-0.14
	(-1.36)
Revenue per FTE*African American	-0.29**
	(-2.39)
Revenue per FTE*Hispanic	-0.11*
	(-1.86)
Revenue per FTE*Other Race	0.14
	(0.94)
Revenue per FTE*Foreign-born	0.088
	(1.60)
Observations	2,352
R-squared	0.661

Robust t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

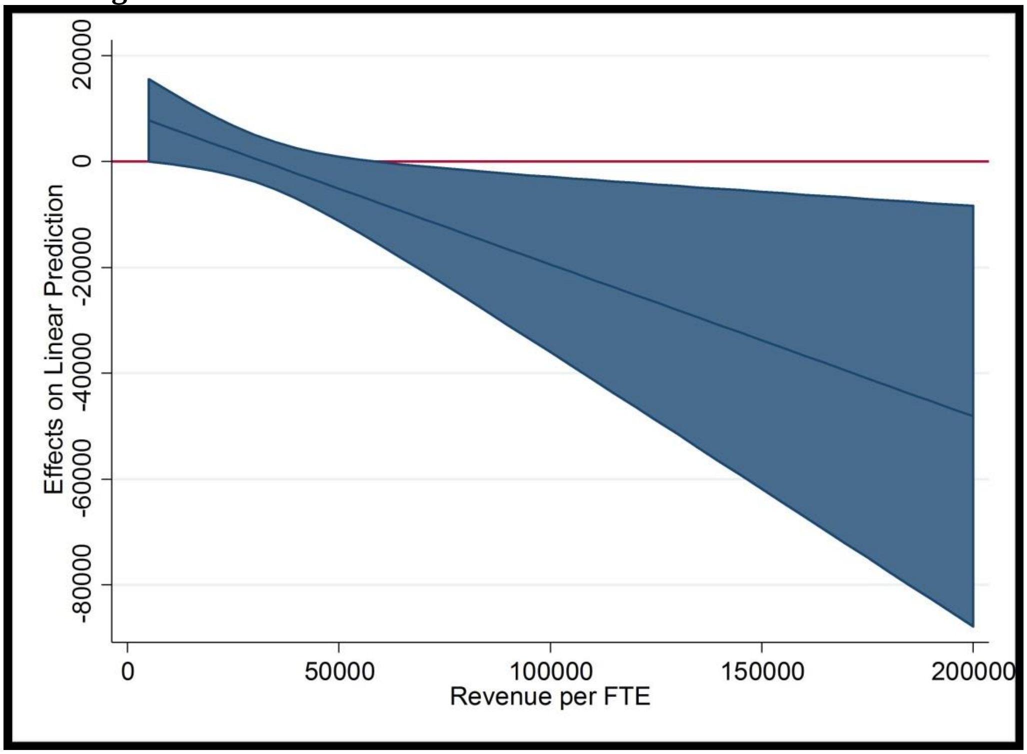
Note: Same controls as Table 4.4. Full table available in Appendix A.13.

Figure 4.1 **Salary Gap Between Male and Female STEM Faculty Associated with Organizational Resources**



Note: The graph displays 95% confidence interval around the estimated salary gap. All other variables are held at their means.

Figure 4.2 **Salary Gap Between African American and White Faculty Associated with Organizational Revenues**



Note: The graph displays 95% confidence interval around the estimated salary gap. All other variables are held at their means.

The composition of revenues may also influence the pay conditions within organizations. Similar to overall resources, private funds may enable institutions to compete for faculty (Alexander, 2001), while public funds may require greater transparency and accountability (Rainey, et al., 1995). Hypothesis 2b states that pay equity will be greater as reliance on public funds grows.

As mentioned previously, private status and public revenues are highly correlated. Thus, models displayed in Table 4.9 test the influence of rising shares of public funds on pay equity for faculty in private and public institutions separately. For private institutions, the results show that greater reliance on public funds brings larger gaps in pay for both women and underrepresented minorities—contrary to expectations. Figures 4.3 and 4.4 display the gender and racial pay gaps for faculty in private institutions with a reliance on public funds ranging from zero to 20 percent, holding all other variables to their means. The gender pay gap becomes significant between 10 and 15 percent of revenues from public sources, while the racial pay gap reaches significance around 20 percent of revenue from public sources (0.05 significance level). Similar to overall resources, very few private institutions reach this level of reliance on public resources. In the weighted sample, 155 faculty work in private institutions with public revenue greater than 20 percent.

In contrast to faculty in private institutions, men and women in public institutions do not experience pay gaps associated with the institution's reliance on public funds. Further, the salary gap between underrepresented minority faculty and white and Asian STEM faculty is in the opposite direction in public as compared to private institutions. As reliance on public funds increases in public institutions, the gap between URM and non-URM faculty decreases, as hypothesized (Figure 4.5). The racial pay gap in public institutions starts off as significant, then narrows to an insignificant pay gap as share of public funds reaches 60 percent. What this shows is that the racial pay gap is significant in more "privatized" public institutions.

Table 4.9 **Influence of Public Revenue on Salary Equity (Abbreviated Models)**

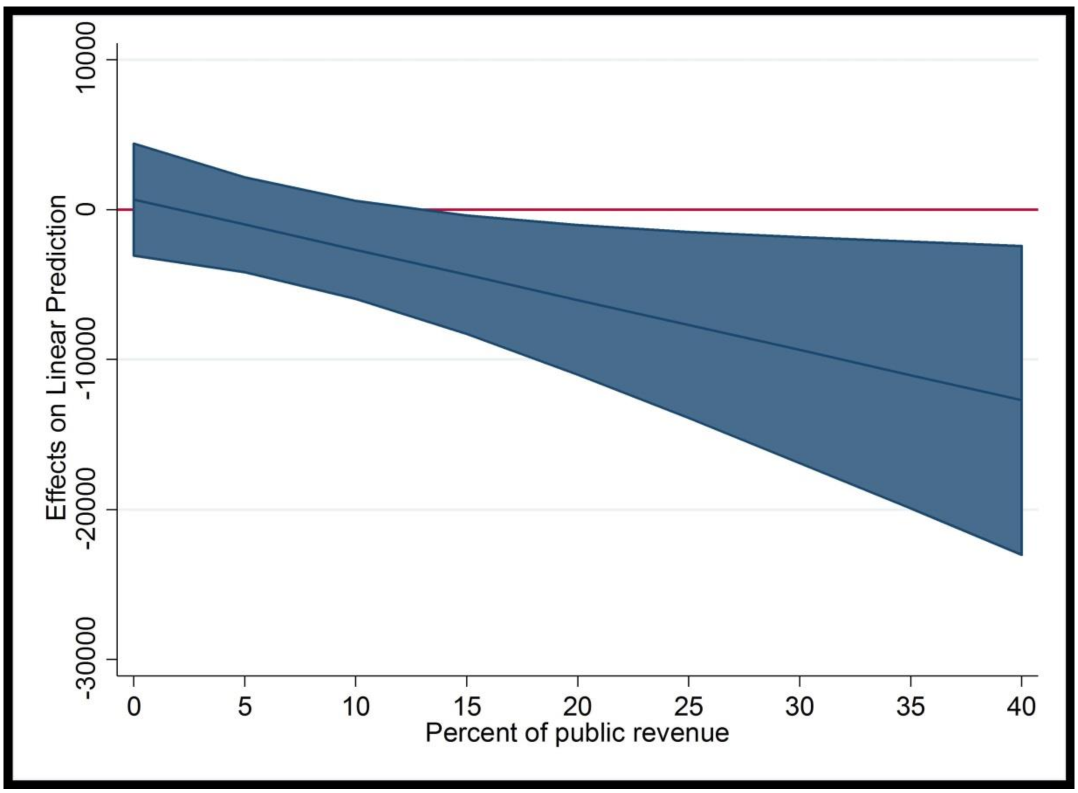
VARIABLES	(Model 1) Private	(Model 2) Public
Percent of revenue from public sources*Female	-335**	-59.2
	(-2.22)	(-0.57)
Percent of revenue from public sources*URM	-451**	292**
	(-2.08)	(2.34)
Percent of revenue from public sources*Foreign-born	-32.7	21.3
	(-0.21)	(0.16)
Observations	976	1,370
R-squared	0.642	0.681

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

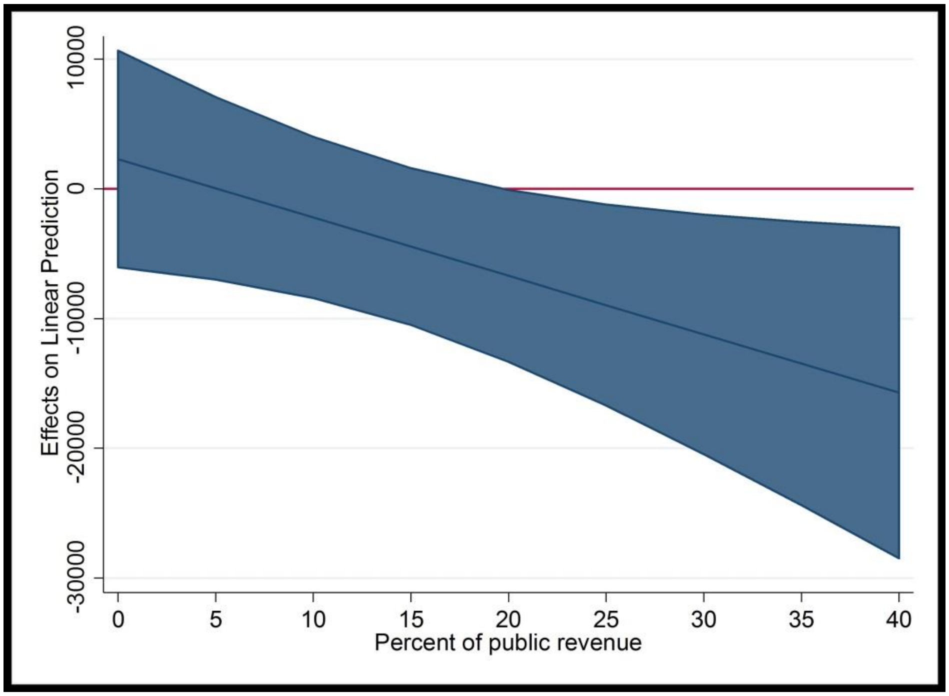
Note: Same controls at Table 4.4. Full table available in Appendix A.14. Public Institutions column does not include Liberal Arts control as there are no Liberal Arts faculty in public institutions.

Figure 4.3 **Gender Pay Gap in Private Institutions with Greater Reliance on Public Revenues**



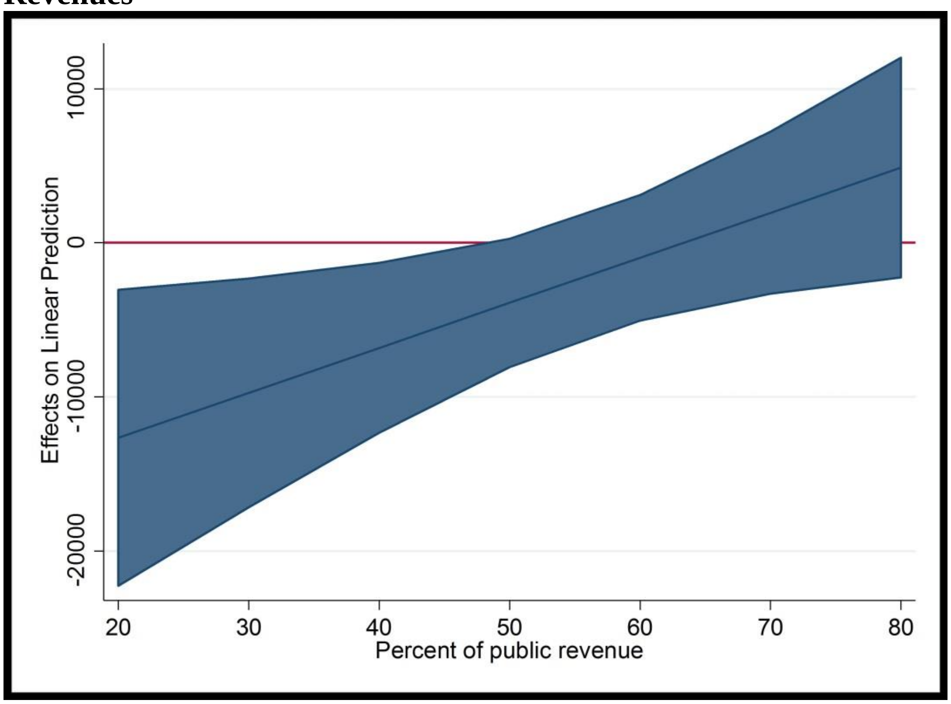
Note: The graph displays 95% confidence interval around the estimated salary gap. All other variables are held at their means.

Figure 4.4 **Racial Pay Gap in Private Institutions with Greater Reliance on Public Revenues**



Note: The graph displays 95% confidence interval around the estimated salary gap. All other variables are held at their means.

Figure 4.5 **Racial Pay Gap in Public Institutions with Greater Reliance on Public Revenues**



Note: The graph displays 95% confidence interval around the estimated salary gap. All other variables are held at their means.

In summary, the influence of public funds on salary gaps differs notably between public and private institutions and offers conflicting support for the hypothesis. In public institutions, the composition of funds acts as hypothesized for racial groups—narrowing the pay gap as public funds increase. The effects of public funds on gender are not significant in public institutions. In private institutions, the results disconfirm the hypothesis for both gender and race. The results in Table 4.9 do not distinguish between type of public funding—federal, state, or local. Public funds in private institutions are primarily federal funds, while there is a greater mix of federal and state funds within public institutions. Thus, the conflicting results may point to distinctions between the influence of federal and state public funds.

Tables 4.10 and 4.11 draw out federal and state funds to observe their effects separately.[23] When controlling for years of experience, field, and Carnegie-institutional type, pay gaps grow for women, underrepresented minorities, and foreign-born faculty as reliance on federal funds grows in private institutions. Those effects become insignificant with the addition of career advancement controls, but the signs remain in the negative direction, and do so in public institutions as well. State appropriations, on the other hand, are uniformly positive, but insignificant, in interactions. Although most of these interactions with federal and state funds are insignificant or weak, results are suggestive that federal and state funds influence pay gaps in opposing ways. Federal funds seem to act as private funds were expected to act—driving salaries apart—while state funds appear to act as the hypothesized "public" funds.

[23] The classification of federal and state funds comes from the IPEDS Delta Cost Project—the same database as all other institutional resource data in this dissertation. Federal funds are federal grants, contracts, and appropriations net of Pell Grants. State funds are state appropriations, excluding grants, contracts, and capital appropriations. The analysis divides these two types of funds by stable operating revenue to get a share of revenues coming from each source.

Table 4.10 **Influence of State Appropriations as Share of Operating Revenues in Public Institutions**

VARIABLES	
Percent of revenue from state funds*Female	160
	(0.99)
Percent of revenue from state funds * URM	206
	(1.03)
Percent of revenue from state funds * Foreign-born	0.33
	(0.0019)
Observations	1,350
R-squared	0.680

t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Note: Same controls at Table 4.4. Full table available in Appendix A.15. Public Institutions does not include Liberal Arts control as there are no Liberal Arts faculty in public institutions.

Table 4.11 **Influence of Federal Funds as Share of Operating Revenues**

	Private		**Public**	
	(Model 1)	(Model 2)	(Model 1)	(Model 2)
VARIABLES	Years of experience, Field, and Institutional Type	Plus career advance-ment traits	Years of experience, Field, and Institutional Type	Public plus career advance-ment
Pct. of revenue from federal funds*Female	-424*	-288	-79.0	-53.1
	(-1.93)	(-1.41)	(-0.42)	(-0.32)
Pct. of revenue from federal funds*URM	-581**	-452	-136	-156
	(-2.58)	(-1.54)	(-0.52)	(-0.62)
Pct. of revenue from federal funds*Foreign-born	-497**	-415	-181	-393*
	(-2.12)	(-1.57)	(-0.82)	(-1.74)
Observations	976	976	1,370	1,370
R-squared	0.538	0.655	0.469	0.681

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Same controls at Table 4.4. Full table available in Appendix A.16. Public Institutions column does not include Liberal Arts control as there are no Liberal Arts faculty in public institutions.

4.3.5 Department Head Discretion Impacts Racial Pay Gaps

The power to distribute resources is the final hypothesized relationship. The expectation here is that pay disadvantages among women and underrepresented minority STEM faculty will be greater in institutions that give greater discretion to department heads in salary and job incentive decisions. The results do not show a significant effect of department head discretion on pay gaps between women and men or URM and white and Asian faculty (Table 4.12). However, disaggregation of race refines those results. As department head discretion increases, the pay gap between African American faculty and comparable white faculty increases as well. Thus, hypothesis 3 receives support for certain racial groups, but not by gender. Figure 4.6 displays the growing pay gap between African American and white faculty under higher levels of department head discretion. The gap reaches significance at discretionary levels of 20 to 25, and about 34 percent of faculty in the weighted sample work in institutions with discretionary levels greater than 20. Finally, foreign-born faculty experience a significant salary disadvantage compared to native-born faculty in higher discretionary institutions, but only in simpler models controlling for gender, race, years of experience, and field.

Although the results on department head discretion are not robust for several groups, it is notable how other salary determinants vary under different levels of discretion. Years of experience are more important at lower levels of discretion, while mobility influences salary more in higher discretion environments (Appendix Table A.17). These results support Pfeffer and Ross's (1990) contention that discretion allows individual level characteristics such as additional job offers or mobility, in this case, to influence pay.

Table 4.12 **Effects of Department Head Discretion on STEM Faculty Salaries (Abbreviated Model)**

VARIABLES	
Department head discretion*Female	-17.6
	(-0.059)
Department head discretion*URM	-600
	(-1.58)
Department head discretion*Foreign-born	-583
	(-1.59)
Observations	736
R-squared	0.674

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

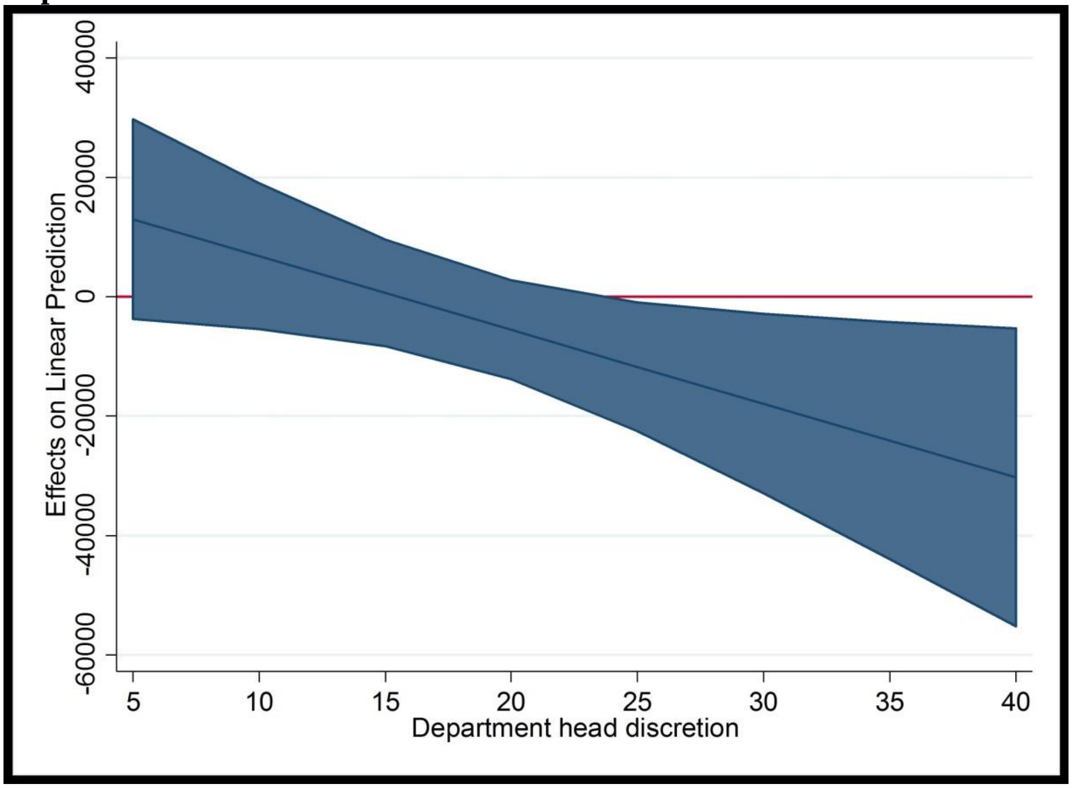
Note: Same control variables as Table 4.4. Full table available in Appendix A.17. This table does not control for Carnegie-classification institutional type since the subsample is from research institutions.

Table 4.13 **Effects of Department Head Discretion on STEM Faculty Salaries, Disaggregated Race/Ethnicity**

VARIABLES	
Department head discretion*Female	-28.3
	(-0.093)
Department head discretion*Asian	151
	(0.33)
Department head discretion*African American	-1,237**
	(-2.22)
Department head discretion*Hispanic	30.7
	(0.060)
Department head discretion*Other Race	-690
	(-0.87)
Department head discretion*Foreign-born	-693
	(-1.55)
Observations	736
R-squared	0.676

Robust t-statistics in parentheses;*** p<0.01, ** p<0.05, * p<0.1
Note: Same control variables as Table 4.4 plus private status. Full table available in Appendix A.18. This table does not control for Carnegie-classification institutional type since the subsample is from research institutions.

Figure 4.6 **Pay Gap between African American and White STEM Faculty as Department Head Discretion Increases**



Note: The graph displays 95% confidence interval around the estimated salary gap. All other variables are held at their means.

4.4 Summary of Findings

The models presented here were designed to test the influence of institutional factors on gender and racial pay gaps among STEM faculty. Hypotheses addressed the role of institutional identity, organizational resources, and department head discretion in explaining discrepancies in faculty salaries among women and underrepresented minorities. Overall, the results, which are summarized in Table 4.14, present a mix of support. Gender pay gaps show a significant difference based on institutional mission of access, total organizational resources, and composition of resources (private institutions only), although some of those relationships are in the opposite direction of the hypotheses. Composition of organizational resources has conflicting effects on racial pay gaps across private and public institutions, raising the possibility that federal funds act as private funds and drive URM salaries farther apart from white and Asian faculty salaries. African American faculty have significant pay gaps with white faculty based on total organizational resources and department head discretion. The next chapter provides a review and interpretation of these results, along with a discussion of the theoretical and policy implications.

Table 4.14 **Summary of Findings**

Hypothesis	Support	Evidence
Institutional Identity		
H1a: Pay disparities among STEM faculty will be lower in institutions with a mission of serving underrepresented groups.	Gender: Yes/No Race: No	Significant difference in the gender salary gap between HBCU/Women's colleges and other institutions. Larger gender salary gap in HBCU/Women's colleges; however, it is in the direction of advancing underrepresented populations.
H1b: Pay disparities among STEM faculty will be greater in private institutions than in public institutions.	Gender: No Race: No	Weak evidence that women earn less than comparable men in private institutions; however, the difference in gender gaps between public and private institutions is insignificant. Foreign-born faculty earn less than comparable native-born faculty in public institutions, whereas they do not in private institutions. The difference in the foreign-born gap for faculty in public and private institutions is significant.
Organizational Resources		
H2a: Pay disparities among STEM faculty will be higher in institutions with greater institutional resources.	Gender: Yes Race: Yes	Pay gaps increase with revenues per student for women, African-American, and Hispanic faculty compared to male and white faculty.
H2b: Pay disparities will be higher in institutions that rely less on public funding.	Gender: No Race: Partial	Opposite of the hypothesized relationship, in private institutions, the gender and racial pay gaps widen as reliance on public funds increases. As hypothesized, the racial pay gap shrinks as reliance on public funds increases within public institutions. Disaggregation of public funds suggests that federal funds may act as "private" funds and drive salaries apart, while state funds may act as the hypothesized "public" funds and shrink pay gaps.
Organizational Power		
H3: Pay disparities among STEM faculty will be greater in institutions with more autonomous department heads.	Gender: No Race: Yes	The salary gap between African-American and comparable white faculty increases as discretionary authority increases.

CHAPTER 5: CONCLUSION

5.1 Introduction

This dissertation argued that individual and disciplinary explanations for faculty pay equity are not sufficient to understand the conditions of women and underrepresented minority STEM faculty. Although individual characteristics, particularly human capital and productivity, and discipline have the ability to explain pay gaps among faculty, they fail to distinguish important organizational features that alter those results. The analysis here supports that argument. Preliminary models mimicked traditional models on pay equity, looking to individual and disciplinary explanations. Results showed an insignificant pay gap for women and men with similar years of experience and field and an insignificant pay gap among racial groups with similar productivity. Additionally, traditional comparisons of institutional type based on the Carnegie-classification showed gender and racial pay parity, with one exception.

Going deeper into institutional factors, however, provides evidence that pay equity depends on organizational setting. As Stainback and colleagues (2010, p. 242) note: “When we recognize the role of organizations as inequality-generating settings, it becomes clear that there are as many education returns or gender wage gaps as there are workplaces…” In that vein, this dissertation shows that institutions’ missions, resources, and decision-making structures influence the level of pay disparity by gender and race. This chapter reviews the findings of the dissertation and their contribution to the pay equity literature, discussing the implications for theory, policy, and future research as well as limitations.

5.2 Overview of Findings on Institutional Influence of Salary Equity

The two primary findings for gender pay equity are that women earn more than comparable men in institutions focused on access for underrepresented groups, while men receive a salary advantage as institutional resources increase. These findings speak to the hypothesized tension of equity and competition within higher education institutions. On the side of equity, female and male STEM faculty working in the HBCU/Women's colleges category earn comparable *average* salaries. One reason for this equity at the mean is that female and male faculty in HBCUs and women's colleges are similar on many important salary determinants. For example, women and men are on par for years of experience and administrative experience in HBCUs and women's colleges, which is not the case in other institutional types. The female salary advantage in HBCU/Women's colleges appears in simple models controlling for experience and field and remains with the addition of career advancement and human capital controls. This result is surprising given the overwhelming consistency of male salary advantages in academia. Institutional identity of inclusion does not shrink the gender pay gap to insignificance, but seems to rather push the gap significantly in favor of women. The few studies measuring the pay gap in these types of institutions have contended that a mission of access relates to a focus on equity; however, their results show a smaller gender pay gap at these institutions but not a significant female advantage as this dissertation finds (Hirsch & Leppel, 1982; Renzulli, et al., 2006). Thus, the results here go further than prior literature in demonstrating a different value system in these institutions than in other institutions related to rewards across gender.

In contrast to the female salary advantage in institutions with a mission of access, male STEM faculty appear to benefit from larger organizational resources in keeping with the hypothesis on competition. Organizational resources drive up men's salaries at a faster rate than women's, thereby increasing the pay gap. This result supports Tolbert's findings (1986) on the role of organizational resources in gender pay.

While those two institutional factors influence the gender pay gap, the other hypothesized relationships were weak or nonexistent. Women in private institutions have a weak, but significant pay gap with men, whereas women in public institutions do not. Those relationships conform to expectations; however, the difference in the gender pay gaps between public and private institutions failed to reach significance. The lack of significance is interesting given recent findings on average faculty pay in public and private institutions. Private institutions are pulling away from public institutions in average salary and are in a better position to compete for top faculty (Rippner & Toutkoushian, 2015). Results here also show a salary premium for STEM faculty working in a private institution. If private institutions continue to increase their pay compared to public institutions and compete for top faculty, scholars should attend to whether that pay and competition will disproportionately benefit male faculty, who are older and more prevalent and prominent in research institutions.

Two hypotheses were not confirmed for gender—composition of funds and department head discretion. In fact, contrary to expectations, the gender salary gap increases in private institutions that are more reliant on public funds. This result raises the possibility that all public funds are not the same, as federal funds may act in an opposite manner to state funds with regards to pay gaps.

Although the analysis confirms expectations for gender by institutional identity and total resources, the findings on racial pay gaps are less compelling in the aggregate. The one significant result for URM faculty is the influence of public resources, which diminish pay gaps in public institutions yet increase pay gaps in private institutions. Again, this seems to be due to important distinctions between the effects of federal and state funds. Other institutional factors do not appear to influence racial pay gaps. Disaggregation of race is key, though, in observing additional variation according to institutional factors. African American and Hispanic faculty have a growing salary disadvantage compared to comparable white faculty with greater revenues per student. This finding extends the prior findings by Tolbert (1986) to race, and similar to gender, speaks to the possibility that resources exacerbate faculty pay gaps through competition for faculty. Finally, African American faculty have a growing gap with white STEM faculty with greater department head discretion, confirming expectations that discretionary environments can produce differential rewards (Pfeffer & Ross, 1990).

5.3 Additional Findings

Gender and racial pay gaps across institutional settings were the focus of this dissertation; however, results highlighted additional important findings on the condition of women and minorities in STEM and reward structures across academia. The results for foreign-born faculty are particularly compelling. In the dissertation's traditional human capital and disciplinary models, foreign-born faculty experience a salary gap with comparable native-born faculty—whereas women and minorities do not. Even when controlling for academic rank, foreign-born faculty have a salary gap. Using the 2001 SDR, Corley and Sabharwal (2007) found that foreign-born STEM faculty earned $1,188 less than comparable U.S.-born faculty. The foreign-born salary gap here is $5,500, or $3,500 when controlling for rank. Thus, human capital and structural theories fail to explain the salary gaps based on nativity. For institutional setting, foreign-born faculty have a salary disadvantage in research extensive, masters, public, high federal funded, and high discretion institutions (models without career advancement traits only).

Several common explanations for salary gaps were not supported by the results. Number of hours worked, marital status, and parental status did not significantly influence salary or show gender or racial patterns related to salary among comparable STEM faculty. Number of hours worked is a key feature of current economic explanations of gender pay gaps in the labor market broadly (Goldin, 2014); however, the results of this dissertation do not offer support for hourly effort driving pay differentials. The results on marriage and family support recent findings on academic faculty which find similar salaries regardless of marriage and parenthood (Kelly & Grant, 2012), yet go against findings in the labor market more broadly. One issue to note is that the data are cross-sectional, and thus do not capture those faculty who exited completely or shifted to non-tenure-track, part-time positions due to family considerations. As other authors have noted, the findings possibly understate the influence of marriage and children on salary given these data limitations (Fox, 2005). Two other common explanations—negotiation and networks—did increase salary, but similar to hours worked and family status did not vary significantly by gender or race in the full models. Interestingly, at the mean, women were more likely to have negotiated their first job offer and received all of their request, in contrast to findings in the labor market broadly (Babcock & Laschever, 2003).

Looking at the returns to different characteristics across gender and race, female STEM faculty have a few interesting advantages. The salary effects of mobility and stop-the-clock policies are better for women than for men. Women are less mobile; however, the salary gain from an additional tenure track position is more for women than for men ($5,600 versus $2,200). These findings contradict previous findings in which mobility in academia broadly did not matter much to faculty earnings and in fact hurt women's earnings in the first job change (Barbezat & Hughes, 2001). The conflicting results point to the possibility that mobility is valued differently in STEM disciplines than in academia broadly or that mobility has become more important since those previous findings. The influence of stop-the-clock policies were likewise surprising, particularly in light of recent findings that such policies can help men more than women in promotion (Antecol, Bedard, & Stearns, 2016).[24] Extending the tenure clock did not significantly affect women's pay. In contrast, men who stopped the clock earned $8,600 less than comparable men who did not. A study of one research university found that stopping-the-clock hurt both men and women, but men more so, and argued the decision to stop the clock signaled to the department a lower level of commitment on the part of the faculty member (Manchester, Leslie, & Kramer, 2013). Future research could explore these results on mobility and stop-the-clock policies further to find why they contradict prior findings for the academe at large, as well as how they differ across institutional types as the prior literature focuses on research institutions.

5.4 Theoretical Implications

The findings provide several theoretical insights. First, institutional identity appears to influence conditions within an organization. As discussed in Chapter 2, organizational

[24] The study focused on economic faculty in the top research universities in the U.S.

identity is the core feature of an organization (Albert & Whetten, 1985), which in this case is inclusion in higher education of formerly excluded populations. Women earn more than comparable men in these settings, suggesting support for founding effects in which certain values are instilled in the organization at its inception and carried through organizational structure and practice (Stinchcombe, 1965). There are other possible explanations for this phenomenon. Composition effects, wherein the representation of women in higher ranks aids women in lower ranks, could be at work. A higher share of women in full professor ranks can lower pay gaps among junior faculty (Lee & Won, 2014), but has not been found to push the salary advantage in favor of women as is the case here. Another possible theoretical lens is gendered organizations, in which bureaucratic forms of organization instill inequality throughout work systems (Acker, 1990). HBCUs and women's colleges have hierarchical features in both the ranking system and the administrative structure similar to other colleges, so again it is difficult to say these organizations are less "masculine" than other institutions. Future research could compare HBCUs and women's colleges to predominately black institutions and former women's colleges in order to test more directly these theories of mission and founding effects, composition, and gendered organizational structure.

Second, the results for public ownership and financial "publicness" contradict theoretical expectations. Gender and racial pay gaps are insignificant across the public/private distinction, while foreign-born faculty are experiencing larger gaps with native-born faculty in public compared to private institutions. These results—particularly for foreign-born faculty—call into question the public/private dichotomy, which poses public institutions as more accessible, transparent, and accountable (Goodsell, 2015;

Mandel & Semyonov, 2014). Further, financial publicness appears to be an insufficient concept for pay equity in higher education. Reliance on public resources acts in opposing manners for public and private institutions—increasing pay gaps in private settings and diminishing pay gaps in public settings. Public funds at private institutions are almost wholly federal funds, whereas they are a mix of federal and state funds in public institutions. The results suggest that there may be important distinctions between federal and state funds in the concept of "publicness." State appropriations, which are associated with instruction, may be acting similar to the concept of "publicness," while federal funds act in the direction (albeit not at a statistically significant level) of organizational resources—negatively affecting pay equity. Federal funds may be more in line with resource dependency theory as external research grants encourage competition and power structures (Salancik & Pfeffer, 1974).

Finally, department head discretion showed significant influence for one group in the full models—African American faculty compared to white faculty—and a second group in simpler models—foreign-born faculty. Moreover, the returns to experience, mobility, network ties, and teaching, among others, varied according to the amount of power placed in the hands of department heads. These results support theories of formalization in pay-setting, in which managerial discretion alters the influence of salary determinants and opens the possibility of pay disparities (Pfeffer & Ross, 1990). The pay formalization literature typically focuses on consequences for women, which these findings do not support, and does not offer evidence on race or nativity. Thus, the findings here offer key evidence that discretion influences the conditions of minority and foreign-born faculty.

The discussion above highlights important institutional variations in pay equity; however, it is interesting how institutions are quite similar in their returns to many other characteristics. For the comparison of HBCU/Women's colleges and other institutions, for example, the only significant differences between the two institutional types were the influence of gender, experience, liberal arts setting, and private status. All other characteristics received similar salary treatments at the two institutional types. Another striking example is the negative returns to teaching across institutional categories, including liberal arts institutions. Thus, while organizational setting influences pay gaps in important ways, the many similarities in reward structures across institutional categorizations supports institutional theory's isomorphism in which organizations mimic each other in their structures and practices (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). The findings on pay gaps thus may be even more surprising as gender and race continue to influence pay in spite of the vast similarities in salary determinants across organizational settings.

5.5 Policy Implications

Higher education institutions are not going to level resources, change their public/private status, or become HBCUs or women's colleges in the name of pay equity; however, policy interventions can be attuned to those institutional variations. Currently in the U.S., federal and state policy proposals on pay equity in the overall labor force focus on salary transparency, compensation panels, paid leave, minimum wage, legal ramifications, and enforcement efforts (American Association of University Women, 2016; United States Office of Personnel Management, 2014; White House Office of the Press Secretary, 2016). Recommendations from the U.S. Office of Personnel Management (OPM) for the federal government workforce offer policy proposals that may be more in line with what higher education institutions can undertake—more so than minimum wage or new legal guidelines. OPM (2014) recommends closing the gender pay gap by enhancing starting-salary transparency and paying greater attention to salary-setting discretion or flexibility. Within higher education, institutions and professional associations have implemented or proposed salary committees, negotiation training, salary ratios and caps, and programs to aid in the recruitment, retention, and promotion of women and minority faculty. While this dissertation did not evaluate the effectiveness of any policy in resolving pay disparities, the results provide insight into several of these policies.

Although it is generally thought that public institutions have greater pay equity, the results here do not robustly support that argument. It is notable, then, that the federal recommendations have recognized the need for additional salary transparency within the federal government, even as prominent policy proposals focus on the need for private sector salary transparency (e.g. Paycheck Fairness Act). The results here support the need for attention to pay equity in both public and private settings. Policies within the public setting need to address the disparities among native-born and foreign-born faculty, in particular, as the nativity gap is higher in public than in private institutions, greater as federal funding reliance increases, and pronounced in multiple Carnegie-classification institutional types. It is worth noting, though, that the reward structures at public and private institutions vary with regards to productivity and discipline. Thus, transparency alone will likely not bring public and private institutions in line with one another in that they place different values on certain faculty characteristics.

Public administration scholars have long debated the benefits and drawbacks of managerial flexibility (see, for example, Friedrich and Finer in Stillman II, 2010), but the results here suggest that institutions need, at a minimum, to recognize how flexibilities are used and whether those flexibilities benefit certain groups. Pay-setting flexibility in OPM's recommendations is a similar concept to the discretionary authority modeled in this dissertation in that managers go beyond salary scales. OPM recommends that federal agencies regularly review their pay-setting flexibilities to identify whether they use these flexibilities more often for certain groups. Likewise, higher education institutions could review the discretionary authority available to department heads and the use of that discretion for faculty salaries by gender and race. Additionally, as higher education institutions adopt more flexible budgetary models such as resource-centered budgeting and shift additional authority to departments, administrators should be attuned to whether such flexibilities will influence pay gaps. Beyond that level of awareness and data collection, some institutions have moved to using salary committees, which expands faculty involvement in salary-setting. Future research could explore the reward systems under a committee structure versus an autonomous department head to identify how outcomes vary.

Many of the existing policies and programs in STEM address how to attract women and underrepresented minorities into STEM overall and male-dominated STEM fields, in particular, and how to ensure those groups persist and advance. According to the results in this dissertation, the issue of persistence and advancement will be key in resolving the salary gap over time. Years of experience overwhelmingly explains pay gaps compared to other factors—much more so than discipline. Women and underrepresented minorities are younger in PhD years. Further, the payoff for each additional year is significantly less for URM faculty compared to white and Asian faculty (Appendix A.7). The salary benefit of administrative experience is also substantial, thus institutional efforts to advance women and minorities into leadership positions will likewise diminish the total salary gap. In terms of recruitment, the National Research Council (2010) recommends search committee strategies that can increase female applicants and hires, such as women serving on and chairing the search committee. Spousal hiring is another recruitment strategy on which the data shed light. Forty percent of women in this survey are married to an academic, while 20 percent of male faculty have an academic partner. Thus, spousal hiring policies may be more important to female academics' mobility. These policies deserve further research in light of women's lower mobility and higher returns from mobility. Finally, stop-the-clock policies are also related to retention and promotion, and the results here show that such policies are not harming women's salary, but are detrimental to male faculty salaries. As noted earlier, future research should explore this impact for male faculty, as well as the impact of such policies across institutional settings.

5.6 Implications for Future Research

Several areas for future research have been noted already, including stop-the-clock policies, salary committees, faculty mobility, mission versus composition effects, and federal versus state funds effects. This dissertation also raises considerations for pay equity research related to organizational setting and race/ethnicity.

The central claim of this dissertation is that organizational setting matters to pay equity. As shown, organizational mission, resources, and discretionary power relate to the conditions of women and minority STEM faculty. STEM scholarship has often focused on research universities since they train future scientists, house the majority of academic scientists, and produce more research than other institutions. However, the federal government through programs such as the National Science Foundation's ADVANCE has called for additional attention to scientists and engineers in other institutions. This dissertation supports that claim and suggests that there are important differences in conditions across organizational setting that warrant further research.

In addition to disaggregating institutions, the results here call for disaggregation of race/ethnicity and nativity when possible. As higher education scholars have found, disaggregation of race can alter findings on pay gaps (Toutkoushian, 1998a). In this dissertation, there were notable differences in pay experiences between African American and Hispanic faculty, who are often grouped as underrepresented minority, as well as differences between white and Asian faculty, who are likewise grouped together in the STEM literature. This dissertation did not examine the intersection of race and gender, but such further disaggregation should be explored.

5.7 Limitations

There are several limitations in answering the question of organizational influences on pay equity among STEM faculty, as well in expanding the interpretations to other academic fields or the broader labor force. First, salary is one reward for STEM faculty, in addition to equipment, travel, and lab space, among others. It is not possible to measure those additional rewards using the NETWISE II Survey dataset. While salary is an important overall reward and has been shown to vary systematically by group here, these other rewards offer incentives and prestige that may heighten or diminish disparities among STEM faculty. Second, the data are self-reported and cross-sectional. Factors such as the influence of marriage and parenthood might be understated, if those factors have caused certain faculty to exit the academic workforce entirely. Third, future research should explore additional ways of measuring discretionary authority. Here, the measure draws from STEM department heads' responses and creates an institutional average of those individual power indices. This institutional-level measure misses the variability across departments in levels of discretion. Fourth, the analysis does not account for the possibility that certain characteristics lead faculty members to locate in particular institutional types. Rather, the study looks to identify how salary gaps vary across institutional types. Finally, it is questionable whether these organizational influences are consistent across academic fields, or particular to STEM fields. For example, STEM fields may respond differently to organizational resources and discretionary authority given the prevalence of grants within those fields.

In spite of these limitations, the research here points to the importance of contextual explanations in pay disparities and provides a platform for further exploration of organizational influences on the conditions of women and underrepresented minorities in STEM. The research makes contributions in several ways. The dissertation examines more recent data, which is valuable as pay gaps continue to evolve and women and underrepresented minorities grow their shares within STEM. The findings expand our understanding of pay gaps across racial groups and among foreign-born faculty—groups that have been neglected in the pay equity literature. Finally, the dissertation provides insights both theoretically and practically that further awareness of organizational levers playing a role in pay disparities among STEM faculty.

APPENDIX A

FULL MODELS

Table A.1 **Descriptive Statistics for Subsample in Research Institutions, Weighted**

	Mean	SD	Minimum	Maximum
Dependent variable				
Salary	$101,895	$36,779	$43,000	$300,000
Key independent variables				
Female	27%	45%	0	1
Underrepresented minority	8%	28%	0	1
Department head discretion	17.80	6.68	1.46	40.63
Control variables: Personal characteristics				
Married or living in a marriage-like relationship	88%	33%	0	1
Divorced/separated/widowed	7%	25%	0	1
Single	6%	23%	0	1
Cared for children	52%	50%	0	1
Native-born U.S. citizen	66%	47%	0	1
Control variables: Human capital				
Years since PhD	22.61	11.69	2	51
Years since PhD squared	647.90	589.38	4	2,601
Postdoctoral appointment	73%	45%	0	1
Worked in government	18%	39%	0	1
Worked in private industry	22%	41%	0	1
Worked in nonprofit organization	5%	23%	0	1
Control variables: Career advancement				
Mobility	1.41	0.93	0	30
12 month contract	15%	36%	0	1
Journal articles	6.36	6.44	0	80
Grant funds awarded (‘000s)	$639	$1,540	0	$33,500
Percent of time on teaching	32%	18%	0	100
Average weekly hours worked	55.45	11.17	5	100
Network ties	9.84	3.95	1	26
Negotiation ability	10%	31%	0	1
Current or past chair/dean	20%	40%	0	1
Chaired professorship	9%	28%	0	1
Research director	8%	27%	0	1
Assistant	20%	40%	0	1
Associate	30%	46%	0	1
Full	50%	50%	0	1
Extended tenure clock	10%	29%	0	1
Control variables: Department				
Civil Engineering	24%	43%	0	1
Biology	40%	49%	0	1
Biochemistry	13%	34%	0	1

Table A.1 (continued)				
Math	23%	42%	0	1
Department size	34.00	21.60	3	139
Control variable: Institution				
Private	22%	41%	0	1
Observations	736			

Table A.2 **Difference of Means by Gender, Weighted**

	Full Sample				Subsample			
	Male	**Female**	**Difference**		**Male**	**Female**	**Difference**	
Salary	$ 96,696	$ 81,862	$ 14,834	**	$ 107,138	$ 87,885	$ 19,252	**
Underrepresented minority	8%	9%	-1%		8%	9%	-1%	
HBCU or women's college	4%	7%	-3%	**				
Private	31%	36%	-6%	*	22%	21%	1%	
Revenue per FTE	$ 42,007	$ 44,104	$ (2,097)					
Percent of revenue from public sources	43%	39%	4%	**				
Department head discretion					17.90	17.50	0.40	
Married/marriage-like relationship	90%	79%	11%	**	90%	80%	10%	**
Divorced/separated/widowed	5%	8%	-3%		6%	10%	-4%	
Single	4%	12%	-8%	**	4%	10%	-6%	**
Cared for children	51%	60%	-8%	**	49%	62%	-13%	*
Foreign-born	31%	23%	8%	**	36%	28%	7%	
Years since PhD	23	17	6	**	25	17	7	**
Years since PhD squared	661	366	295	**	746	385	361	**
Postdoctoral appointment	65%	70%	-5%	*	69%	81%	-11%	**
Worked in government	18%	15%	3%		19%	17%	2%	
Worked in private industry	24%	15%	9%	**	26%	12%	14%	**
Worked in nonprofit organization	5%	7%	-1%		5%	7%	-2%	
Mobility	1.43	1.18	0.25	**	1.49	1.19	0.31	**
12 month contract	15%	12%	3%		16%	15%	1%	
Journal articles	5.42	4.13	1.29	**	6.64	5.63	1.01	
Grant funds awarded (000s)	$ 514	$ 385	$ 129		$ 648	$ 616	$ 32	
Percent of time on teaching	41%	45%	-4%	**	32%	33%	-1%	
Average weekly hours worked	54.05	54.84	-0.79		55.45	55.45	0.00	
Network ties	9.39	9.81	-0.42		9.81	9.92	-0.11	

Table A.2 (continued)

Negotiation ability	8%	13%	-4%	*	9%	15%	-6%	
Current or past chair/dean	28%	18%	10%	**	23%	10%	13%	**
Chaired professorship	9%	4%	5%	**	11%	3%	8%	**
Research director	9%	3%	6%	**	10%	2%	8%	**
Assistant	17%	33%	-16%	**	15%	34%	-19%	**
Associate	30%	38%	-8%	**	27%	37%	-10%	*
Full	54%	29%	24%	**	58%	29%	29%	**
Extended tenure clock	6%	19%	-13%	**	6%	19%	-13%	**
Civil Engineering	21%	13%	8%	**	27%	17%	10%	**
Biology	38%	53%	-15%	**	34%	55%	-22%	**
Biochemistry	13%	13%	-1%		14%	12%	2%	
Math	28%	21%	7%	**	26%	16%	10%	*
Department size	26.48	25.21	1.27		33.92	34.20	-0.28	
Research Extensive	53%	48%	5%					
Research Intensive	18%	18%	1%					
Liberal Arts	8%	14%	-6%	**				
Masters	21%	21%	0%					
Observations	1321	1031			372	364		

** $p<0.01$, * $p<0.05$

Table A.3 **Difference of Means by URM Status, Weighted**

	Full Sample				Subsample			
	White or Asian	**URM**	**Difference**		**White or Asian**	**URM**	**Difference**	
Salary	$ 93,293	$ 81,911	$ 11,383	**	$ 103,161	$ 88,201	$ 14,960	**
Female	29%	32%	-3%		27%	29%	-2%	
HBCU or women's college	4%	19%	-15%	**				
Private	32%	34%	-1%		21%	29%	-8%	
Revenue per FTE	$ 42,046	$ 48,970	$ (6,924)					
Percent of revenue from public sources	42%	45%	-3%					
Department head discretion					17.70	18.80	-1.10	
Married/marriage-like relationship	88%	81%	6%		88%	88%	0%	
Divorced/separated/widowed	6%	10%	-4%		7%	9%	-2%	
Single	7%	8%	-2%		6%	4%	2%	
Cared for children	54%	54%	-1%		52%	54%	-2%	
Foreign-born	27%	46%	-19%	**	32%	52%	-20%	*
Years since PhD	21.48	17.83	3.65	**	23.03	18.08	4.95	*
Years since PhD squared	588.00	424.90	163.10	*	667.30	437.80	229.50	*
Postdoctoral appointment	66%	70%	-4%		72%	75%	-3%	
Worked in government	17%	13%	4%		19%	9%	10%	*
Worked in private industry	21%	22%	0%		22%	19%	3%	
Worked in nonprofit organization	6%	3%	3%	**	6%	1%	5%	**
Mobility	1.35	1.44	-0.09		1.40	1.57	-0.18	
12 month contract	14%	10%	5%		16%	9%	7%	
Journal articles	5.14	3.96	1.18	**	6.45	5.43	1.02	
Grant funds awarded (000s)	$ 474	$ 502	$ (27)		$ 633	$ 706	$ (73)	
Percent of time on teaching	42%	42%	0%		32%	29%	3%	

Table A.3 (continued)

Average weekly hours worked	54.23	54.92	-0.69		55.30	57.06	-1.76	
Network ties	9.47	10.03	-0.56		9.77	10.67	-0.90	
Negotiation ability	10%	7%	3%		11%	6%	5%	
Current or past chair/dean	25%	18%	8%	*	21%	6%	14%	**
Chaired professorship	8%	3%	5%	**	9%	2%	8%	**
Research director	7%	3%	5%	**	9%	1%	7%	**
Assistant	20%	32%	-12%	*	19%	34%	-15%	
Associate	31%	39%	-7%		29%	38%	-9%	
Full	48%	29%	19%	**	52%	28%	24%	**
Extended tenure clock	9%	13%	-4%		9%	15%	-6%	
Civil Engineering	18%	18%	0%		24%	24%	0%	
Biology	42%	51%	-9%		39%	49%	-10%	
Biochemistry	13%	10%	3%		13%	11%	2%	
Math	27%	21%	5%		24%	16%	8%	
Department size	26.15	25.61	0.54		33.96	34.41	-0.45	
Research Extensive	52%	53%	-1%					
Research Intensive	19%	13%	5%					
Liberal Arts	10%	9%	0%					
Masters	20%	25%	-4%					
Observations	2071	281			632	104		

** p<0.01, * p<0.05

Table A.4 **Traditional Human Capital and Disciplinary Models with Disaggregated Race/Ethnicity**

VARIABLES	(1) Demographics	(2) Plus Experience & Field	(3) Plus Other Human Capital & Career Advancement	(4) Plus Departmental
Female	-14,944***	-2,034	104	24.9
	(-7.70)	(-1.38)	(0.087)	(0.021)
Asian	-3,687	874	3,585	3,643
	(-0.73)	(0.22)	(1.14)	(1.15)
Black/African American	-11,796***	-5,254**	-1,815	-1,131
	(-3.77)	(-2.04)	(-0.81)	(-0.52)
Hispanic	-10,772***	-811	242	462
	(-3.71)	(-0.29)	(0.099)	(0.19)
Other race	-8,993*	-16,163***	-11,456***	-12,877***
	(-1.72)	(-2.93)	(-2.81)	(-2.63)
Foreign-born	-2,182	781	-5,268**	-5,521**
	(-0.58)	(0.26)	(-2.17)	(-2.29)
Years since PhD		1,795***	1,202***	1,169***
		(15.7)	(11.7)	(11.4)
Postdoctoral appointment			4,763**	4,747**
			(2.35)	(2.34)
Mobility			2,736***	2,696***
			(2.91)	(2.86)
12 month contract			8,640***	9,022***
			(3.04)	(3.21)
Journal articles			197	196
			(1.00)	(1.01)
Grant funds awarded ('000s)			1.90**	1.69*
			(2.00)	(1.85)
Percent of time on teaching			-382***	-360***
			(-7.46)	(-6.81)
Network ties			573***	550***
			(2.81)	(2.68)
Negotiation ability			5,030*	5,233*
			(1.73)	(1.79)
Extended tenure clock			-3,740**	-3,738**
			(-2.43)	(-2.43)
Current or past chair/dean			10,237***	11,445***
			(3.84)	(4.11)
Chaired professorship			25,724***	25,994***
			(5.90)	(5.99)
Research director			10,127***	10,402***
			(2.79)	(2.84)

Table A.4 (continued)

Biology		-18,996***	-18,808***	-18,541***
		(-7.12)	(-8.41)	(-8.22)
Biochemistry		-9,679***	-11,439***	-10,559***
		(-3.22)	(-4.42)	(-4.11)
Math		-19,468***	-11,875***	-11,747***
		(-7.64)	(-5.38)	(-5.36)
Department size				123**
				(2.43)
Constant	98,722***	69,408***	75,959***	72,302***
	(51.5)	(25.3)	(18.3)	(16.3)
Observations	2,352	2,352	2,352	2,352
R-squared	0.049	0.389	0.592	0.596

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.5 **Salary Determinants with Faculty Rank**

VARIABLES	(1) Demographics	(2) Plus Experience & Field	(3) Plus Other Human Capital & Career Advancement	(4) Plus Departmental	(5) Plus Institutional
Female	-15,008***	-888	525	439	-507
	(-7.74)	(-0.66)	(0.47)	(0.40)	(-0.48)
Underrepresented minority	-10,348***	-2,940	-1,712	-1,577	-2,610
	(-4.97)	(-1.46)	(-1.05)	(-0.92)	(-1.56)
Foreign-born	-3,354	1,978	-3,277*	-3,515**	-2,774
	(-1.24)	(0.94)	(-1.83)	(-1.97)	(-1.61)
Assistant		-25,578***	-17,398***	-17,063***	-17,371***
		(-9.32)	(-7.31)	(-7.15)	(-7.72)
Associate		-24,498***	-16,578***	-16,571***	-16,695***
		(-10.4)	(-9.12)	(-9.13)	(-9.29)
Years since PhD		1,030***	740***	714***	714***
		(6.93)	(5.77)	(5.57)	(5.82)
Postdoctoral appointment			4,890***	4,889***	2,699
			(2.66)	(2.65)	(1.47)
Mobility			2,567***	2,531***	2,870***
			(2.72)	(2.66)	(2.91)
12 month contract			9,108***	9,458***	9,155***
			(3.35)	(3.52)	(3.47)
Journal articles			142	142	131
			(0.77)	(0.77)	(0.81)
Grant funds awarded ('000s)			1.80**	1.61*	1.82**
			(1.99)	(1.87)	(2.18)
Percent of time on teaching			-352***	-331***	-288***
			(-7.32)	(-6.75)	(-5.49)

Table A.5 (continued)

Network ties		417**	394*	266
		(2.09)	(1.96)	(1.29)
Negotiation ability		4,948*	5,140*	5,573*
		(1.66)	(1.72)	(1.83)
Extended tenure clock		-1,670	-1,699	-2,388
		(-1.08)	(-1.10)	(-1.61)
Current or past chair/dean		8,314***	9,460***	8,384***
		(3.19)	(3.47)	(3.08)
Chaired professorship		24,867***	25,103***	22,995***
		(5.80)	(5.87)	(5.46)
Research director		8,942**	9,222**	8,742**
		(2.44)	(2.50)	(2.54)
Biology	-16,825***	-17,600***	-17,379***	-14,819***
	(-6.75)	(-8.58)	(-8.39)	(-6.80)
Biochemistry	-8,370***	-10,908***	-10,118***	-8,741***
	(-2.89)	(-4.36)	(-4.06)	(-3.40)
Math	-19,295***	-12,594***	-12,496***	-12,051***
	(-8.23)	(-6.13)	(-6.06)	(-5.65)
Department size			114**	96.1*
			(2.29)	(1.76)
Research Intensive				-5,548***
				(-2.80)
Liberal Arts				36.8
				(0.014)
Masters				-3,203
				(-1.60)
Private				2,266
				(0.68)
HBCU or Women's College				-1,505
				(-0.90)

Table A.5 (continued)

Revenue per FTE					0.13***
					(3.72)
Percent of public revenue					-43.9
					(-0.68)
Constant	98,573***	97,068***	95,119***	91,590***	89,246***
	(51.1)	(23.7)	(20.5)	(18.5)	(14.8)
Observations	2,352	2,352	2,352	2,352	2,352
R-squared	0.048	0.455	0.619	0.623	0.651

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.6 **Salary Determinants by Gender with Marital and Parental Status**

VARIABLES	(1) Male	(2) Female	Difference
Underrepresented minority	-2,419	-366	2,053
	(-1.03)	(-0.14)	(0.60)
Foreign-born	-5,265**	-1,217	4,048
	(-2.14)	(-0.74)	(1.37)
Years since PhD	1,148***	1,164***	16.1
	(8.95)	(9.47)	(0.091)
Postdoctoral appointment	5,937**	1,553	-4,384
	(2.20)	(1.00)	(-1.41)
Mobility	2,199**	5,622***	3,423*
	(2.22)	(3.54)	(1.83)
12 month contract	8,330**	12,863***	4,533
	(2.39)	(4.28)	(0.99)
Journal articles	129	471**	342
	(0.62)	(2.27)	(1.16)
Grant funds awarded ('000s)	1.72	1.86*	0.14
	(1.64)	(1.71)	(0.095)
Percent of time on teaching	-427***	-200***	227***
	(-6.02)	(-4.80)	(2.76)
Network ties	531*	393**	-138
	(1.90)	(2.22)	(-0.42)
Negotiation ability	5,356	4,337*	-1,019
	(1.25)	(1.85)	(-0.21)
Extended tenure clock	-8,646***	278	8,924***
	(-3.75)	(0.14)	(2.94)
Current or past chair/dean	12,900***	7,096***	-5,804
	(3.81)	(3.02)	(-1.41)
Chaired professorship	25,738***	25,273***	-464
	(5.14)	(4.60)	(-0.062)
Research director	9,908**	5,268	-4,640
	(2.37)	(1.15)	(-0.75)
Biology	-19,072***	-19,420***	-347
	(-6.80)	(-7.89)	(-0.093)
Biochemistry	-10,593***	-12,572***	-1,979
	(-3.15)	(-4.46)	(-0.45)
Math	-12,620***	-14,081***	-1,461
	(-4.57)	(-6.05)	(-0.40)
Department size	100	148***	47.9
	(1.61)	(3.30)	(0.63)
Cared for children	740	-201	-942
	(0.35)	(-0.14)	(-0.36)

Table A.6 (continued)

Divorced/separated/widowed	-1,483	2,661	4,145
	(-0.31)	(0.87)	(0.72)
Single	-1,183	1,966	3,150
	(-0.32)	(0.78)	(0.70)
Constant	77,239***	63,756***	77,239***
	(12.9)	(15.7)	(12.9)
Observations	1,321	1,031	2,352
R-squared	0.593	0.558	0.603

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A.7 **Salary Determinants by URM Status**

VARIABLES	White/Asian	Underrepresented Minority	Difference
Female	140	-1,466	-1,605
	(0.11)	(-0.50)	(-0.51)
Foreign-born	-4,742**	-2,790	1,952
	(-2.39)	(-0.93)	(0.54)
Years since PhD	1,181***	661***	-520***
	(10.7)	(4.28)	(-2.74)
Postdoctoral appointment	4,773**	4,238	-535
	(2.24)	(1.52)	(-0.15)
Mobility	3,428***	1,660*	-1,768
	(2.61)	(1.65)	(-1.07)
12 month contract	8,844***	12,355**	3,511
	(3.01)	(2.10)	(0.53)
Journal articles	173	1,107*	934
	(0.92)	(1.92)	(1.54)
Grant funds awarded ('000s)	1.78*	-0.021	-1.80
	(1.77)	(-0.022)	(-1.29)
Percent of time on teaching	-365***	-324***	40.6
	(-6.37)	(-3.93)	(0.40)
Network ties	526**	403	-124
	(2.35)	(1.19)	(-0.31)
Negotiation ability	4,749	7,891	3,143
	(1.53)	(1.32)	(0.47)
Extended tenure clock	-3,844**	-781	3,063
	(-2.40)	(-0.19)	(0.71)
Current or past chair/dean	11,158***	13,258***	2,100
	(3.82)	(3.43)	(0.43)
Chaired professorship	25,531***	20,019*	-5,512
	(5.74)	(1.91)	(-0.48)
Research director	10,562***	6,800	-3,763
	(2.80)	(0.74)	(-0.38)
Biology	-18,886***	-15,537***	3,349
	(-7.94)	(-4.48)	(0.80)
Biochemistry	-10,426***	-15,201***	-4,775
	(-3.86)	(-3.10)	(-0.85)
Math	-12,011***	-9,357***	2,654
	(-5.11)	(-2.66)	(0.63)
Department size	128**	64.7	-63.0
	(2.39)	(0.77)	(-0.64)
Constant	72,053***	76,771***	72,053***
	(15.0)	(11.1)	(15.0)
Observations	2,071	281	2,352
R-squared	0.599	0.509	0.599

t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table A.8 **Salary Determinants by Carnegie-classification Institutional Type**

VARIABLES	Research Extensive	Research Intensive	Masters	Liberal Arts
Female	-1,688	-1,099	901	90.9
	(-0.76)	(-0.56)	(0.68)	(0.045)
Underrepresented minority	-3,321	-12,189***	859	4,449
	(-1.12)	(-3.57)	(0.54)	(0.94)
Foreign-born	-5,235**	-2,563	-2,894*	-1,062
	(-1.98)	(-1.07)	(-1.70)	(-0.40)
Years since PhD	1,254***	897***	997***	1,609***
	(7.51)	(6.22)	(10.8)	(11.4)
Postdoctoral appointment	8,825**	-1,310	-479	4,405**
	(2.08)	(-0.45)	(-0.28)	(2.44)
Mobility	3,526**	1,353	111	3,093
	(2.34)	(0.80)	(0.087)	(1.21)
12 month contract	10,479**	10,092**	8,317	3,384
	(2.55)	(2.11)	(1.61)	(0.91)
Journal articles	609***	-63.5	10.1	899*
	(2.83)	(-1.10)	(0.068)	(1.71)
Grant funds awarded ('000s)	2.85**	1.47	0.23	0.047
	(2.23)	(1.34)	(0.47)	(0.083)
Percent of time on teaching	-457***	-109	-267***	-277***
	(-4.91)	(-0.91)	(-3.84)	(-3.71)
Network ties	162	405	870**	385*
	(0.48)	(1.12)	(2.54)	(1.70)
Negotiation ability	5,231	3,629	796	4,323
	(1.16)	(0.98)	(0.30)	(1.20)
Current or past chair/dean	17,816***	14,634***	4,516***	3,892*
	(3.33)	(3.30)	(2.63)	(1.73)
Chaired professorship	23,130***	28,406**	29,395*	13,484***
	(4.07)	(2.49)	(1.94)	(4.09)
Research director	11,802**	9,568**	3,675	1,182
	(2.34)	(2.47)	(0.82)	(0.24)
Biology	-18,776***	-24,153***	-15,811***	-22,882***
	(-5.15)	(-6.75)	(-7.45)	(-5.92)
Biochemistry	-10,515**	-20,143***	-10,450***	-23,900***
	(-2.36)	(-5.93)	(-4.66)	(-5.97)
Math	-12,537***	-21,597***	-9,667***	-18,497***
	(-2.71)	(-5.11)	(-3.44)	(-4.71)
Department size	95.8	594***	230**	686***
	(1.48)	(3.46)	(2.41)	(2.87)
Private	6,342*	9,611***	3,403	
	(1.72)	(2.71)	(1.57)	
Constant	70,473***	63,836***	68,862***	70,210***
	(9.67)	(6.52)	(17.4)	(9.37)
Observations	698	498	656	500
R-squared	0.647	0.485	0.548	0.582

t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table A.9 **Comparison of Salary Determinants at HBCU/Women's Colleges and Other Institutions**

VARIABLES	(1) HBCU/Women's	(2) Other	Difference
Female	5,765**	-655	6,420**
	(2.01)	(-0.53)	(2.06)
Underrepresented minority	-832	-3,258	2,425
	(-0.28)	(-1.60)	(0.68)
Foreign-born	891	-3,788**	4,679
	(0.33)	(-2.03)	(1.42)
Years since PhD	829***	1,160***	-331*
	(5.76)	(11.1)	(-1.86)
Postdoctoral appointment	2,647	3,686*	-1,039
	(0.98)	(1.68)	(-0.30)
Mobility	2,963	2,784***	178
	(1.25)	(2.78)	(0.069)
12 month contract	20,776**	8,379***	12,397
	(2.07)	(2.90)	(1.19)
Journal articles	158	226	-67.5
	(0.85)	(1.14)	(-0.25)
Grant funds awarded ('000s)	-1.84	1.83**	-3.67
	(-0.80)	(2.02)	(-1.49)
Percent of time on teaching	-358***	-351***	-7.64
	(-3.92)	(-5.77)	(-0.070)
Network ties	340	434**	-93.1
	(0.87)	(1.98)	(-0.21)
Negotiation ability	13,998	4,408	9,591
	(1.56)	(1.45)	(1.01)
Extended tenure clock	334	-4,616***	4,951
	(0.096)	(-2.96)	(1.30)
Current or past chair/dean	7,946***	11,101***	-3,155
	(2.70)	(3.76)	(-0.76)
Chaired professorship	25,031***	24,319***	712
	(2.74)	(5.37)	(0.070)
Research director	3,096	10,440***	-7,344
	(0.49)	(2.81)	(-1.00)
Biology	-10,444***	-17,758***	7,314
	(-2.68)	(-7.12)	(1.58)
Biochemistry	-12,127**	-10,708***	-1,419
	(-2.41)	(-3.82)	(-0.25)
Math	-9,947***	-12,100***	2,153
	(-2.72)	(-4.99)	(0.49)
Department size	335*	109*	225
	(1.66)	(1.86)	(1.07)

Table A.9 (continued)

Research Intensive	2,686	-7,584***	10,270
	(0.36)	(-3.48)	(1.34)
Liberal Arts	17,756**	-1,913	19,669**
	(2.34)	(-0.64)	(2.41)
Masters	4,501	-4,900**	9,400
	(0.62)	(-2.11)	(1.24)
Private	-1,350	6,832***	-8,182**
	(-0.42)	(2.90)	(-2.04)
Constant	61,033***	74,898***	74,898***
	(5.85)	(15.0)	(15.0)
Observations	267	2,085	2,352
R-squared	0.527	0.611	0.612

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A.10 **Additive Model of Salary Determinants at HBCU/Women's Colleges**

VARIABLES	(1) Demographics	(2) Plus Experience & Field	(3) Plus Other Human Capital & Career Advancement	(4) Plus Departmental	(5) Plus Institutional
Female	2,160	6,217*	5,722*	5,737**	5,765**
	(0.55)	(1.72)	(1.93)	(1.99)	(2.01)
Underrepresented minority	-1,729	-1,101	-2,978	-3,005	-832
	(-0.40)	(-0.30)	(-1.16)	(-1.14)	(-0.28)
Foreign-born	-4,335	-47.7	-96.6	-123	891
	(-1.24)	(-0.016)	(-0.034)	(-0.044)	(0.33)
Years since PhD		1,371***	771***	770***	829***
		(8.97)	(5.29)	(5.35)	(5.76)
Postdoctoral appointment			3,439	3,431	2,647
			(1.25)	(1.25)	(0.98)
Mobility			1,658	1,668	2,963
			(0.75)	(0.76)	(1.25)
12 month contract			21,383**	21,355**	20,776**
			(2.20)	(2.17)	(2.07)
Journal articles			129	130	158
			(0.70)	(0.72)	(0.85)
Grant funds awarded ('000s)			-2.44	-2.46	-1.84
			(-1.00)	(-1.01)	(-0.80)
Percent of time on teaching			-346***	-346***	-358***
			(-3.93)	(-3.85)	(-3.92)
Network ties			636*	638*	340
			(1.79)	(1.77)	(0.87)
Negotiation ability			13,796	13,804	13,998
			(1.46)	(1.47)	(1.56)

Table A.10 (continued)

Extended tenure clock			1,845	1,880	334
			(0.49)	(0.50)	(0.096)
Current or past chair/dean			8,851***	8,915***	7,946***
			(2.77)	(2.99)	(2.70)
Chaired professorship			29,728***	29,775***	25,031***
			(3.17)	(3.19)	(2.74)
Research director			2,647	2,654	3,096
			(0.43)	(0.43)	(0.49)
Biology		-7,369**	-8,037**	-8,157**	-10,444***
		(-2.15)	(-2.15)	(-2.09)	(-2.68)
Biochemistry		-2,171	-5,137	-5,258	-12,127**
		(-0.51)	(-1.06)	(-1.14)	(-2.41)
Math		-9,683***	-7,365**	-7,502**	-9,947***
		(-2.82)	(-1.99)	(-2.04)	(-2.72)
Department size				19.0	335*
				(0.090)	(1.66)
Research Intensive					2,686
					(0.36)
Liberal Arts					17,756**
					(2.34)
Masters					4,501
					(0.62)
Private					-1,350
					(-0.42)
Constant	78,511***	55,346***	70,539***	70,359***	61,033***
	(28.4)	(12.3)	(9.94)	(8.76)	(5.85)
Observations	267	267	267	267	267
R-squared	0.009	0.272	0.503	0.503	0.527

t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table A.11 **Comparison of Salary Determinants in Public and Private Institutions**

VARIABLES	(1) Private	(2) Public	Difference
Female	-3,131*	562	-3,693
	(-1.68)	(0.36)	(-1.53)
Underrepresented minority	-4,374	-2,606	-1,768
	(-1.41)	(-1.22)	(-0.47)
Foreign-born	1,136	-5,702***	6,838*
	(0.41)	(-2.65)	(1.95)
Years since PhD	1,142***	1,122***	20.6
	(7.97)	(9.18)	(0.11)
Postdoctoral appointment	5,700**	2,678	3,023
	(2.14)	(0.99)	(0.80)
Mobility	2,734	2,855**	-122
	(1.41)	(2.51)	(-0.054)
12 month contract	8,628**	9,632***	-1,003
	(2.02)	(2.70)	(-0.18)
Journal articles	1,041***	124	917**
	(3.14)	(0.75)	(2.47)
Grant funds awarded ('000s)	3.31*	1.75*	1.57
	(1.81)	(1.87)	(0.76)
Percent of time on teaching	-216**	-360***	144
	(-1.99)	(-5.30)	(1.12)
Network ties	756**	227	529
	(2.18)	(0.86)	(1.22)
Negotiation ability	-1,125	6,590*	-7,715
	(-0.31)	(1.71)	(-1.45)
Extended tenure clock	-3,237*	-5,963***	2,726
	(-1.74)	(-2.72)	(0.95)
Current or past chair/dean	10,973***	12,720***	-1,746
	(2.79)	(3.65)	(-0.33)
Chaired professorship	19,188***	27,577***	-8,389
	(3.70)	(4.67)	(-1.07)
Research director	4,701	11,623***	-6,922
	(0.84)	(2.61)	(-0.97)
Biology	-20,251***	-18,511***	-1,741
	(-6.39)	(-6.06)	(-0.40)
Biochemistry	-19,609***	-7,597**	-12,011**
	(-5.25)	(-2.21)	(-2.37)
Math	-18,294***	-10,749***	-7,545
	(-4.65)	(-3.51)	(-1.51)
Department size	593***	55.1	538**
	(2.94)	(1.00)	(2.57)
Research Intensive	-1,037	-8,624***	7,587
	(-0.24)	(-3.62)	(1.53)

Table A.11 (continued)

Masters	1,299	-5,229**	6,528
	(0.26)	(-2.14)	(1.16)
Liberal Arts	8,330**	-8,464	16,794*
	(2.02)	(-0.93)	(1.68)
Constant	58,831***	80,091***	80,091***
	(6.14)	(14.4)	(14.4)
Observations	976	1,376	2,352
R-squared	0.586	0.648	0.628

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.12 **Influence of Organizational Revenues on Salary Determinants**

VARIABLES	
Female	2,687
	(1.50)
Underrepresented minority	-702
	(-0.29)
Foreign-born	-5,727**
	(-2.11)
Years since PhD	879***
	(5.76)
Postdoctoral appointment	-146
	(-0.047)
Mobility	1,453
	(0.78)
12 month contract	1,444
	(0.34)
Journal articles	114
	(0.53)
Grant funds awarded ('000s)	0.23
	(0.19)
Percent of time on teaching	-298***
	(-3.29)
Network ties	250
	(0.81)
Negotiation ability	7,292
	(1.38)
Extended tenure clock	-4,713**
	(-2.00)
Current or past chair/dean	7,415**
	(2.30)
Chaired professorship	23,591***
	(3.70)
Research director	12,754**
	(2.51)
Biology	-20,055***
	(-5.60)
Biochemistry	-14,327***
	(-3.41)
Math	-13,704***
	(-4.10)
Department size	-81.0
	(-0.92)
Research Intensive	-11,590***
	(-3.00)

Table A.12 (continued)

Liberal Arts	-36,922***
	(-6.41)
Masters	-8,196
	(-1.54)
Private	5,649*
	(1.93)
Revenue per FTE	-0.27*
	(-1.66)
Revenue per FTE*Female	-0.12***
	(-2.63)
Revenue per FTE*URM	-0.073
	(-1.46)
Revenue per FTE*Foreign-born	0.051
	(1.08)
Revenue per FTE*Years since PhD	0.0067**
	(2.16)
Revenue per FTE*Postdoctoral apt.	0.078
	(1.07)
Revenue per FTE*Mobility	0.040
	(0.90)
Revenue per FTE*12 month contract	0.16**
	(2.08)
Revenue per FTE*Journal publications	0.00043
	(0.15)
Revenue per FTE*Grant awards	0.000059*
	(1.88)
Revenue per FTE*Time on teaching	-0.0013
	(-0.56)
Revenue per FTE*Network ties	0.00082
	(0.15)
Revenue per FTE*Negotiation ability	-0.049
	(-0.52)
Revenue per FTE*Extended tenure clock	0.0034
	(0.061)
Revenue per FTE*Chair/dean	0.085
	(1.30)
Revenue per FTE*Chaired professorship	-0.034
	(-0.31)
Revenue per FTE*Research director	-0.081
	(-0.83)
Revenue per FTE*Biology	0.095
	(1.36)
Revenue per FTE*Biochemistry	0.052
	(0.58)
Revenue per FTE*Math	0.033

Table A.12 (continued)

	(0.47)
Revenue per FTE*Department Size	0.0046**
	(2.28)
Revenue per FTE*Research Intensive	0.21**
	(2.00)
Revenue per FTE*Liberal Arts	1.12***
	(7.66)
Revenue per FTE*Masters	0.23
	(1.05)
Revenue per FTE*Private	-0.083
	(-1.51)
Constant	87,391***
	(11.4)
Observations	2,352
R-squared	0.657

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.13 **Influence of Organizational Revenues on Salary Determinants, Disaggregated Race/Ethnicity**

VARIABLES	(1) All Interactions
Female	2,800
	(1.53)
Asian	9,355*
	(1.78)
Black/African American	9,217**
	(2.07)
Hispanic	2,932
	(0.95)
Other race	-16,800**
	(-2.16)
Foreign-born	-8,713**
	(-2.39)
Years since PhD	898***
	(5.94)
Postdoctoral appointment	308
	(0.10)
Mobility	1,332
	(0.73)
12 month contract	1,240
	(0.29)
Journal articles	105
	(0.49)
Grant funds awarded ('000s)	0.15
	(0.13)
Percent of time on teaching	-299***
	(-3.34)
Network ties	383
	(1.21)
Negotiation ability	7,971
	(1.53)
Extended tenure clock	-4,322*
	(-1.73)
Current or past chair/dean	7,139**
	(2.24)
Chaired professorship	24,311***
	(3.80)
Research director	13,112***
	(2.60)
Biology	-20,224***
	(-5.56)

Table A.13 (continued)

Biochemistry	-14,077***
	(-3.37)
Math	-12,649***
	(-3.78)
Department size	-77.7
	(-0.88)
Research Intensive	-11,490***
	(-3.02)
Liberal Arts	-37,878***
	(-6.66)
Masters	-8,603
	(-1.62)
Private	5,921**
	(2.03)
Revenue per FTE	-0.24
	(-1.57)
Revenue per FTE*Female	-0.12***
	(-2.63)
Revenue per FTE*Asian	-0.14
	(-1.36)
Revenue per FTE*African American	-0.29**
	(-2.39)
Revenue per FTE*Hispanic	-0.11*
	(-1.86)
Revenue per FTE*Other race	0.14
	(0.94)
Revenue per FTE*Foreign-born	0.088
	(1.60)
Revenue per FTE*Years since PhD	0.0065**
	(2.14)
Revenue per FTE*Postdoctoral appt.	0.062
	(0.89)
Revenue per FTE*Mobility	0.048
	(1.11)
Revenue per FTE*12 month contract	0.16**
	(2.16)
Revenue per FTE*Journal publications	0.00049
	(0.17)
Revenue per FTE*Grant awards	0.000063*
	(1.93)
Revenue per FTE*Time on teaching	-0.0010
	(-0.46)
Revenue per FTE*Network ties	-0.0016
	(-0.27)
Revenue per FTE*Negotiation ability	-0.066

Table A.13 (continued)

	(-0.69)
Revenue per FTE*Extended tenure clock	-0.0071
	(-0.12)
Revenue per FTE*Chair/dean	0.094
	(1.42)
Revenue per FTE*Chaired professorship	-0.051
	(-0.46)
Revenue per FTE*Research director	-0.094
	(-0.96)
Revenue per FTE*Biology	0.11
	(1.47)
Revenue per FTE*Biochemistry	0.056
	(0.62)
Revenue per FTE*Math	0.014
	(0.20)
Revenue per FTE*Department size	0.0046**
	(2.31)
Revenue per FTE*Research Intensive	0.21**
	(2.02)
Revenue per FTE*Liberal Arts	1.13***
	(7.85)
Revenue per FTE*Masters	0.23
	(1.05)
Revenue per FTE*Private	-0.083
	(-1.50)
Constant	84,835***
	(11.5)
Observations	2,352
R-squared	0.661

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.14 **Influence of Reliance on Public Revenue on Salary Determinants in Public and Private Institutions**

VARIABLES	(1) Private	(2) Public
Female	672	3,204
	(0.35)	(0.61)
Underrepresented minority	2,304	-18,504**
	(0.54)	(-2.55)
Foreign-born	3,165	-6,733
	(1.12)	(-1.01)
Years since PhD	993***	1,383***
	(6.35)	(3.92)
Postdoctoral appointment	166	-19,329**
	(0.062)	(-2.53)
Mobility	781	-5,977
	(0.44)	(-1.23)
12 month contract	6,296	-15,716
	(1.37)	(-1.51)
Journal articles	576	1,580**
	(1.27)	(2.23)
Grant funds awarded ('000s)	-0.42	-1.04
	(-0.24)	(-0.28)
Percent of time on teaching	-330**	112
	(-2.58)	(0.61)
Network ties	654	928
	(1.40)	(1.14)
Negotiation ability	3,177	-6,823
	(0.97)	(-0.47)
Extended tenure clock	-1,542	-982
	(-0.78)	(-0.11)
Current or past chair/dean	8,282***	-22,361**
	(2.90)	(-2.45)
Chaired professorship	16,167***	59,083**
	(4.04)	(2.26)
Research director	-4,981	19,458
	(-0.78)	(1.20)
Biology	-24,446***	-10,898
	(-6.03)	(-1.15)
Biochemistry	-28,201***	-16,145
	(-6.55)	(-1.50)
Math	-20,393***	-7,138
	(-3.90)	(-0.83)
Department size	203	-33.7
	(0.95)	(-0.14)

Table A.14 (continued)

Research Intensive	-5,680	-4,584
	(-0.90)	(-0.61)
Liberal Arts	10,195*	
	(1.75)	
Masters	3,128	-6,600
	(0.46)	(-0.91)
Percent of revenue from public sources	-1,473***	56.5
	(-2.63)	(0.17)
Pct. of revenue from public sources*Female	-335**	-59.2
	(-2.22)	(-0.57)
Pct. of revenue from public sources*URM	-451**	292**
	(-2.08)	(2.34)
Pct. of revenue from public sources*Foreign-born	-32.7	21.3
	(-0.21)	(0.16)
Pct. of revenue from public sources*Years since PhD	6.57	-5.39
	(0.70)	(-0.79)
Pct. of revenue from public sources*Postdoctoral appoint	598***	388***
	(3.03)	(2.58)
Pct. of revenue from public sources*Mobility	276**	161*
	(2.12)	(1.67)
Pct. of revenue from public sources*12 month contract	125	431**
	(0.49)	(2.28)
Pct. of revenue from public sources*Journal publications	-8.46	-23.8**
	(-0.60)	(-2.18)
Pct. of revenue from public sources*Grant awards	0.19*	0.051
	(1.68)	(0.74)
Pct. of revenue from public sources*Time on teaching	8.26	-8.40**
	(1.26)	(-2.30)
Pct. of revenue from public sources*Network ties	-8.74	-15.1
	(-0.37)	(-0.96)
Pct. of revenue from public sources*Negotiation ability	-186	247
	(-0.63)	(0.84)
Pct. of revenue from public sources*Extended tenure clock	-92.5	-90.3
	(-0.58)	(-0.51)
Pct. of revenue from public sources*Chair/dean	274	617***
	(1.04)	(3.36)
Pct. of revenue from public sources*Chaired professorship	40.9	-517
	(0.11)	(-1.10)
Pct. of revenue from public sources*Research director	251	-133
	(1.23)	(-0.42)
Pct. of revenue from public sources*Biology	334	-126
	(1.58)	(-0.70)
Pct. of revenue from public sources*Biochemistry	1,022***	129
	(2.85)	(0.61)
Pct. of revenue from public sources*Math	43.3	-87.7

Table A.14 (continued)

	(0.17)	(-0.50)
Pct. of revenue from public sources*Department size	15.6	1.87
	(1.36)	(0.44)
Pct. of revenue from public sources*Research Intensive	403	-69.4
	(1.37)	(-0.49)
Pct. of revenue from public sources*Masters	-433	34.0
	(-1.31)	(0.24)
Pct. of revenue from public sources*Liberal Arts	-137	
	(-0.37)	
Constant	83,059***	77,207***
	(7.47)	(4.45)
Observations	976	1,370
R-squared	0.642	0.681

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.15 **Influence of State Appropriations Share on Salary Determinants in Public Institutions**

VARIABLES	
Female	-3,417
	(-0.84)
Underrepresented minority	-8,505
	(-1.46)
Foreign-born	-4,421
	(-1.03)
Years since PhD	1,426***
	(5.97)
Postdoctoral appointment	-4,385
	(-0.80)
Mobility	4,663
	(1.45)
12 month contract	13,726*
	(1.72)
Journal articles	917*
	(1.70)
Grant funds awarded ('000s)	5.30**
	(2.25)
Percent of time on teaching	-444***
	(-3.09)
Network ties	0.0046
	(8.41e-06)
Negotiation ability	3,063
	(0.43)
Extended tenure clock	-3,736
	(-0.47)
Current or past chair/dean	6,787
	(1.03)
Chaired professorship	28,092**
	(2.26)
Research director	21,686**
	(2.31)
Biology	-7,937
	(-1.17)
Biochemistry	3,087
	(0.33)
Math	7,305
	(1.15)
Department size	-188
	(-1.22)

Table A.15 (continued)

Research Intensive	-21,598***
	(-3.76)
Masters	-20,521***
	(-2.93)
Percent of revenue from state funds	-350
	(-0.78)
Percent of revenue from state funds*Female	160
	(0.99)
Percent of revenue from state funds*URM	206
	(1.03)
Percent of revenue from state funds*Foreign-born	0.33
	(0.0019)
Percent of revenue from state funds*Years since PhD	-11.8
	(-1.35)
Percent of revenue from state funds*Postdoctoral apt.	268
	(1.28)
Percent of revenue from state funds*Mobility	-67.2
	(-0.57)
Percent of revenue from state funds*12 month contract	-151
	(-0.47)
Percent of revenue from state funds*Publications	-36.4*
	(-1.85)
Percent of revenue from state funds*Grant awards	-0.13
	(-1.48)
Percent of revenue from state funds*Time on teaching	3.39
	(0.64)
Percent of revenue from state funds*Network ties	9.56
	(0.44)
Percent of revenue from state funds*Negotiation ability	161
	(0.40)
Percent of revenue from state funds*Extended tenure clock	-30.0
	(-0.10)
Percent of revenue from state funds*Chair/dean	279
	(1.12)
Percent of revenue from state funds*Chaired professorship	-87.2
	(-0.14)
Percent of revenue from state funds*Research director	-458
	(-1.42)
Percent of revenue from state funds*Biology	-458*
	(-1.67)
Percent of revenue from state funds*Biochemistry	-451
	(-1.15)
Percent of revenue from state funds*Math	-737***
	(-2.75)
Percent of revenue from state funds*Department size	9.19

Table A.15 (continued)

	(1.37)
Percent of revenue from state funds*Research Intensive	629**
	(2.50)
Percent of revenue from state funds*Masters	704**
	(2.46)
Constant	86,739***
	(8.01)
Observations	1,350
R-squared	0.680

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.16 **Influence of Federal Revenue Share on Salary Determinants in Public and Private Institutions**

VARIABLES	(1) Private	(2) Private plus career advancement	(3) Public	(4) Public plus career advancement
Female	-889	303	-333	1,770
	(-0.44)	(0.15)	(-0.14)	(0.84)
Underrepresented minority	1,088	1,175	-2,475	54.9
	(0.26)	(0.27)	(-0.83)	(0.019)
Foreign-born	7,939**	7,484**	2,730	-15.3
	(2.20)	(2.54)	(0.88)	(-0.0056)
Years since PhD	1,349***	951***	1,330***	1,105***
	(10.0)	(6.07)	(8.85)	(7.84)
Postdoctoral appointment		-966		-3,034
		(-0.34)		(-1.03)
Mobility		274		-3,795*
		(0.16)		(-1.92)
12 month contract		8,475*		12,050**
		(1.79)		(2.42)
Journal articles		191		472**
		(0.41)		(2.18)
Grant funds awarded ('000s)		2.01		0.81
		(0.87)		(0.60)
Percent of time on teaching		-376***		-179**
		(-2.81)		(-2.43)
Network ties		900*		736**
		(1.73)		(2.21)
Negotiation ability		1,780		-267
		(0.52)		(-0.063)
Extended tenure clock		-1,911		-2,189
		(-0.85)		(-0.59)
Current or past chair/dean		4,598		4,765
		(1.48)		(1.21)
Chaired professorship		19,168***		21,780
		(3.99)		(1.52)
Research director		2,063		10,988*
		(0.31)		(1.70)
Biology	-27,497***	-23,839***	-15,012***	-17,009***
	(-5.37)	(-5.48)	(-3.67)	(-4.43)
Biochemistry	-27,457***	-26,143***	-12,396**	-8,119*
	(-5.16)	(-5.80)	(-2.29)	(-1.80)
Math	-23,852***	-19,801***	-15,755***	-10,291***
	(-3.80)	(-3.59)	(-3.94)	(-2.89)
Department size	259	187	147	30.3

Table A.16 (continued)

	(1.47)	(0.89)	(1.17)	(0.30)
Research Intensive	-11,337	-4,711	-5,066	-3,417
	(-1.51)	(-0.68)	(-1.07)	(-0.90)
Liberal Arts	7,738	10,563		
	(1.13)	(1.60)		
Masters	-1,611	3,738	-3,547	186
	(-0.21)	(0.49)	(-0.77)	(0.048)
Percent of revenue from federal	-490	-2,257***	479	301
funds	(-0.83)	(-2.99)	(0.95)	(0.46)
Pct. of revenue from federal	-424*	-288	-79.0	-53.1
funds*Female	(-1.93)	(-1.41)	(-0.42)	(-0.32)
Pct. of revenue from federal	-581**	-452	-136	-156
funds*URM	(-2.58)	(-1.54)	(-0.52)	(-0.62)
Pct. of revenue from federal	-497**	-415	-181	-393*
funds*Foreign-born	(-2.12)	(-1.57)	(-0.82)	(-1.74)
Pct. of revenue from federal	23.1*	12.3	28.7**	2.86
funds*Years since PhD	(1.72)	(1.01)	(2.12)	(0.19)
Pct. of revenue from federal		921***		503*
funds*Postdoctoral apt.		(3.21)		(1.73)
Pct. of revenue from federal		474**		575***
funds*Mobility		(2.53)		(3.38)
Pct. of revenue from federal		196		-234
funds*12 month contract		(0.59)		(-0.82)
Pct. of revenue from federal		20.2		-16.8***
funds*Publications		(0.86)		(-2.88)
Pct. of revenue from federal		0.046		0.074
funds*Grant awards		(0.30)		(0.80)
Pct. of revenue from federal		16.1*		-13.7*
funds*Time on teaching		(1.81)		(-1.96)
Pct. of revenue from federal		-36.4		-46.3*
funds*Network ties		(-0.96)		(-1.75)
Pct. of revenue from federal		-65.2		553
funds*Negotiation ability		(-0.18)		(1.34)
Pct. of revenue from federal		-188		-191
funds*Extended tenure clock		(-0.64)		(-0.63)
Pct. of revenue from federal		809**		702*
funds*Chair/dean		(2.06)		(1.80)
Pct. of revenue from federal		-108		246
funds*Chaired professorship		(-0.17)		(0.31)
Pct. of revenue from federal		201		339
funds*Research director		(0.54)		(0.60)
Pct. of revenue from federal	706**	366	-281	-116
funds*Biology	(2.11)	(1.17)	(-0.92)	(-0.40)
Pct. of revenue from federal	1,448**	1,006**	375	-143
funds*Biochemistry	(2.31)	(2.24)	(0.99)	(-0.46)

Table A.16 (continued)

Pct. of revenue from federal funds*Math	19.5	82.1	-88.3	-95.6
	(0.053)	(0.24)	(-0.26)	(-0.29)
Pct. of revenue from federal funds*Dept. size	20.4*	19.3	-10.3	1.08
	(1.90)	(1.39)	(-1.04)	(0.16)
Pct. of revenue from federal funds*Research Intensive	891*	448	-528	-258
	(1.65)	(0.96)	(-1.61)	(-0.88)
Pct. of revenue from federal funds*Masters	-796**	-690	-733**	-517
	(-2.21)	(-1.38)	(-2.10)	(-1.49)
Pct. of revenue from federal funds*Liberal Arts	-165	-180		
	(-0.40)	(-0.34)		
Constant	75,253***	85,258***	66,214***	72,872***
	(7.95)	(7.34)	(11.6)	(9.93)
Observations	976	976	1,370	1,370
R-squared	0.538	0.655	0.469	0.681

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.17 **Influence of Department Head Discretion on Salary Determinants**

VARIABLES	
Female	-1,720
	(-0.29)
Underrepresented minority	7,024
	(0.88)
Foreign-born	3,741
	(0.54)
Years since PhD	2,057***
	(6.13)
Postdoctoral appointment	7,084
	(0.78)
Mobility	-11,624**
	(-2.12)
12 month contract	17,255
	(1.49)
Journal articles	1,093
	(1.54)
Grant funds awarded ('000s)	1.24
	(0.45)
Percent of time on teaching	-853***
	(-3.96)
Network ties	1,350*
	(1.84)
Negotiation ability	12,296
	(1.38)
Extended tenure clock	11,605
	(1.42)
Current or past chair/dean	4,935
	(0.44)
Chaired professorship	28,527*
	(1.95)
Research director	24,070**
	(2.15)
Biology	-17,046*
	(-1.76)
Biochemistry	-11,368
	(-1.02)
Math	6,361
	(0.54)
Department size	72.6
	(0.43)
Private	-8,757

Table A.17 (continued)

	(-1.15)
Department head discretion	289
	(0.32)
Department head discretion*Female	-17.6
	(-0.059)
Department head discretion*URM	-600
	(-1.58)
Department head discretion*Foreign-born	-583
	(-1.59)
Department head discretion*Years since PhD	-41.5**
	(-2.33)
Department head discretion*Postdoctoral apt.	25.3
	(0.052)
Department head discretion*Mobility	815***
	(2.75)
Department head discretion*12 month contract	-290
	(-0.48)
Department head discretion*Publications	-23.8
	(-0.72)
Department head discretion*Grant awards	0.029
	(0.19)
Department head discretion*Time on teaching	19.5*
	(1.90)
Department head discretion*Network ties	-77.5*
	(-1.83)
Department head discretion*Negotiation ability	-516
	(-1.17)
Department head discretion*Extended tenure clock	-916**
	(-2.25)
Department head discretion*Chair/dean	539
	(0.83)
Department head discretion*Chaired professorship	-378
	(-0.55)
Department head discretion*Research director	-865
	(-1.36)
Department head discretion*Biology	-87.3
	(-0.17)
Department head discretion*Biochemistry	-29.6
	(-0.052)
Department head discretion*Math	-1,042*
	(-1.65)
Department head discretion*Department size	2.76
	(0.32)
Department head discretion*Private	881**
	(2.09)

Table A.17 (continued)

Constant	70,839***
	(4.12)
Observations	736
R-squared	0.674

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A.18 **Influence of Department Head Discretion on Salary Determinants, Disaggregated Race/Ethnicity**

VARIABLES	
Female	-1,505
	(-0.25)
Asian	1,004
	(0.10)
Black/African American	19,191*
	(1.74)
Hispanic	-1,842
	(-0.17)
Other race	10,200
	(0.74)
Foreign-born	4,686
	(0.56)
Years since PhD	2,025***
	(5.87)
Postdoctoral appointment	7,026
	(0.75)
Mobility	-11,561**
	(-2.05)
12 month contract	16,221
	(1.39)
Journal articles	1,090
	(1.52)
Grant funds awarded ('000s)	1.23
	(0.46)
Percent of time on teaching	-828***
	(-3.86)
Network ties	1,406*
	(1.88)
Negotiation ability	12,419
	(1.39)
Extended tenure clock	12,917
	(1.56)
Current or past chair/dean	4,688
	(0.41)
Chaired professorship	27,740*
	(1.87)
Research director	25,245**
	(2.28)
Biology	-17,711*
	(-1.80)

Table A.18 (continued)

Biochemistry	-11,314
	(-1.01)
Math	5,584
	(0.48)
Department size	87.0
	(0.52)
Private	-9,481
	(-1.25)
Department head discretion	283
	(0.31)
Department head discretion*Female	-28.3
	(-0.093)
Department head discretion*Asian	151
	(0.33)
Department head discretion*African American	-1,237**
	(-2.22)
Department head discretion*Hispanic	30.7
	(0.060)
Department head discretion*Other race	-690
	(-0.87)
Department head discretion*Foreign-born	-693
	(-1.55)
Department head discretion*Years since PhD	-39.4**
	(-2.09)
Department head discretion*Postdoctoral apt.	39.9
	(0.078)
Department head discretion*Mobility	816***
	(2.66)
Department head discretion*12 month contract	-243
	(-0.40)
Department head discretion*Publications	-24.6
	(-0.74)
Department head discretion*Grant awards	0.035
	(0.24)
Department head discretion*Time on teaching	18.5*
	(1.75)
Department head discretion*Network ties	-79.2*
	(-1.81)
Department head discretion*Negotiation ability	-528
	(-1.20)
Department head discretion*Extended tenure clock	-980**
	(-2.37)
Department head discretion*Chair/dean	562
	(0.85)
Department head discretion*Chaired professorship	-315

Table A.18 (continued)

	(-0.45)
Department head discretion*Research director	-924
	(-1.46)
Department head discretion*Biology	-39.7
	(-0.074)
Department head discretion*Biochemistry	-16.1
	(-0.028)
Department head discretion*Math	-969
	(-1.54)
Department head discretion*Department size	1.91
	(0.23)
Department head discretion*Private	935**
	(2.23)
Constant	69,749***
	(4.01)
Observations	736
R-squared	0.676

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